# *Republic of Uganda*

## EDICT OF GOVERNMENT

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US 405 (1995) (English): Shallow Well Handpump (Model U2/U3)

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US 405 : 1995
UDC

# UGANDA STANDARD

Standard Specification

for

# ShallowWell Handpump (Model U2/U3)

First Edition: November 1995

UGANDA NATIONAL BUREAU OF STANDARDS

PRICE GROUP

Descriptors:

**IT IS IMPORTANT THAT USERS OF UGANDA STANDARDS ASCERTAIN THAT THEY ARE IN POSSESSION OF THE LATEST AMENDMENTS OR LATEST EDITIONS**

The following table will assist the user to update the standard

AMENDMENTS

| Clause | Amendment No | Date of issue | Text affected |
|---|---|---|---|
| | | | |
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| | | | |
| | | | |
| | | | |
| | | | |

In order to keep abreast of technological development Uganda Standards are subject to periodic review.

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NOTE:

1. Compliance with a Uganda Standard does not, of itself confer immunity from legal obligations.

2. A Uganda standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application.

## FOREWORD

Today over 700 handpumps are being installed annually in rural communities all over the country. There will be more than 10,000 pumps by the year 2000 in Uganda.

Most of these pumps are left in the hands of the rural folks to maintain (community based maintenance systems). Therefore concern must not only be attached to the purchase price of a pump but most importantly to the long term operating costs and quality of the product. It is in the national interest to ensure that the handpumps being supplied to the rural population are of a standard that supports rural growth to avoid putting on the community a long term financial burden in trying to maintain a poor quality pump.

The importance of this standard is to assure good quality control at affordable costs.

In the preparation of this standard reference was made to:

- The Indian standard for Handpumps IS 13056:1991; and to several ISO and BS standards mentioned therein.

## COMMITTEE MEMBERSHIP

The following organisations were represented on the Technical Committee for Waterpumps which prepared this standard:

- Water Development Department, Ministry of Energy, Water and Mineral Resources
- Rural Water and Sanitation (RUWASA)
- Victoria Pumps Ltd
- Luwero Triangle Reconstruction programme
- World Vision International
- UNICEF
- DANIDA
- UNDP - World Bank and Sanitation Programme
- Faculty of Technology, Makerere University
- Uganda National Bureau of Standards

# UGANDA STANDARD SPECIFICATION FOR SHALLOW WELL HANDPUMPS U2/U3

## 1.0 SCOPE

1.1 This standard covers Handpumps for lifting water from boreholes with static water levels from 3 m up to 21 m.

## 2.0 REFERENCE

2.1 The Standards listed in Annexes A, B & C are necessary adjuncts to this standard.

## 3.0 NOMENCLATURE

3.1 A brief description of some of the components is given below (see Fig. 1 of page 9).

a) ***Pump Head Assembly***

The mechanism above the ground level and operating the plunger. Two options are available : U2 and U3.

b) ***Cylinder Assembly***

Contains components listed in 4.1.7, lifting water upward with very stroke. Cylinder choice will depend on the option chosen: U2 or U3.

c) ***Connecting Rod***

Provides linkage between the pump head and the cylinder.

d) ***Riser Pipe***

Carries water from the cylinder to the water tank. Riser Pipe choice will also depend on the pump option chosen: U2 or U3.

## 4.0 DIMENSIONS AND CONSTRUCTION

4.1 The table below shows the Assemblies with their parts.

| ASSEMBLY | FIGURE NO. | PART(S) |
|---|---|---|
| 4.1.1 Head Assembly | 2 | Head Assembly Parts |
| | 2a | Head before bending option 1 |
| | 2b | Head before welding option 2 |
| | 2c | Front Top End Plate |
| | 2d | Positioning of Bracket on Head |
| | 2e | Bracket or Window |
| | 2f | Bracket before bending option 1 |
| | 2g | Bracket before bending option 2 |
| | 2h | Front Bottom End Plate |
| | 2i | Gusset |
| | 2j | Axle Bush (Right) |
| | 2k | Axle Bush (Left) |
| | 2l | Flange for Head |

| ASSEMBLY | FIGURE NO. | PART(S) |
|---|---|---|
| 4.1.2 Front Cover | 3 | Front Cover Parts |
| | 3a | Front Cover before bending |
| 4.1.3 Third Plate | 4 | Third Plate Parts |
| | 4a | Flange for third plate |
| | 4b | Guide Bush |
| 4.1.4 Handle Assembly | 5 | Handle Assembly Parts |
| | 5a | Handle Bar & Handle Pipe |
| | 5b | Handle Axle |
| | 5c | Chain Guide Assembly Option 1 |
| | 5d | Chain Guide Assembly Option 2 |
| | 5e | Chain Coupling |
| | 5f | Roller Chain |
| | 5g | Bearing Housing |
| 4.1.5 Water Tank Ass. | 6 | Water Tank Assembly Parts |
| | 6a | Top Flange |
| | 6b | Bottom Flange U2 |
| | 6c | Bottom Flange U3 |
| | 6d | Tank Pipe |
| | 6e | Spout Pipe |
| | 6f | Riser Pipe Holder Option 1 |
| | 6g | Riser Pipe Holder Option 2 |
| | 6h | Gusset |
| 4.1.6 Stand Assembly | 7 | Base Plate Option |
| | 7a | 150 & 175 NB Pipe Option 1 |
| | 7b | 150 & 175 NB Pipe Option 2 |
| | 7c | 150 NB Pipe Option 1 |
| | 7d | 150 NB Pipe Option 2 |
| | 7e | 150 NB Pipe for 7 |
| | 7f | 150 NB pipe for 7a |
| | 7g | 150 NB pipe for 7b |
| | 7h | 175 NB pipe for 7 & 7a |
| | 7i | 150 NB pipe for 7b |
| | 7j | 150 NB pipe for 7c |
| Flaring Option | 7k | 150 NB to 175 NB Pipe Welding |
| Reducer Collar Option | 7l | 150 NB to 175 NB Pipe Welding |
| | 7m | Top Flange |
| | 7n | Base Plate for 7 |
| | 7p | Leg |
| | 7q | Top Gusset |
| | 7r | Base Plate Gusset for 7 |
| 4.1.7 Cylinder Assembly U3 | 8 | Cylinder Assembly Parts |
| | 8a | Upper Cap |
| | 8b | Cylinder Body |
| | 8c | Brass Liner |
| | 8d | Bottom Cap |
| | 8e | Upper Valve |
| | 8f | Check Valve |
| | 8g | Spacer |
| | 8h | Push Rod |
| | 8i | Plunger Rod |
| | 8j | Check Valve Seat |
| | 8k | Cage |

| ASSEMBLY | FIGURE NO. | PART(S) |
|---|---|---|
| | 8l | Follower |
| | 8m | 'O' Ring Nitrile Rubber |
| | 8n | Sealing Ring |
| Cylinder Assembly U2 | 9 | Cylinder Assembly Parts |
| | 9a | Reducer Cap |
| | 9b | Cylinder Body |
| | 9c | Brass Liner |
| | 9d | Rubber Seat Retainer |
| | 9e | Spacer for Leather Pump Bucket |
| | 9f | Spacer for Nit.Rubber Pump Bucket |
| | 9g | Check Valve Seat |
| | 9h | Rubber Seating (Upper Valve) |
| | 9i | Rubber Seating (Lower Valve) |
| | 9j | Sealing Ring |
| | 9k | Plunger Rod |
| | 9l | Follower |
| | 9m | Follower (Alternate Design) |
| | 9n | Upper Valve |
| 4.1.8 Connecting Rod | 10 | Connecting Rod Parts |

5.0 **GENERAL REQUIREMENTS**

5.1 The dimensions, tolerances, etc shall be given in the respective figures. General Tolerance unless otherwise specified is ± 0.5 mm.

5.2 The bolts and nuts used for handpump assembly shall conform to ISO 2320:1983, ISO 4014:1988, ISO 4016:1988 and ISO 4034:1986, the specifications of which are listed in Annex A.

5.3 The riser pipe holder (see figure 6e & 6f) welded in the water tank shall be machined from seamless tube or solid bar conforming to ISO 65 : 1981 (Carbon Steel tubes suitable for screwing in accordance with ISO 7-1) or Fe 360 B of ISO 630:1980.

5.4 ***The Riser Pipe***

5.4.1 The riser pipe shall be 32 mm(for U2) or 65 mm(for U3) nominal bore,hot dip galvanised, screwed and socketed, 3 meters in length with a tolerance of + 0 and - 25 mm, and + 0 and - 50 mm respectively. It shall conform to IS 1239(part 1):1979 Medium Class. One end of the riser pipe shall be fitted with a hot dip galvanised socket and the other with a thread protector. Riser Pipes of Stainless Steel may be used in case of corrosive waters(see Annex B).

5.4.2 The socket shall be manufactured from seamless tube or machined from solid bar conforming to specifications in Annex A and shall be hot dip galvanised. Stainless Steel socket may be used with Stainless Steel Pipe as in 5.4.1.

5.5 The welding shall be done in accordance with IS 9595:1980. Welding for stainless steel components shall conform to IS 2811:1987.

5.6 The castings shall be of high grade conforming to Grade FG200 or higher grade of IS 210:1978.

5.7 The Bronze casting shall conform to Grade LTB2 of IS 318:1981.

5.8 The connecting rod shall be of 12 mm diameter conforming to bright bar of type 4 and grade 2 or 3 of steel other than free cutting steel conforming to IS 9550:1980. The electro-galvanizing shall conform to Fe/Zn 25 of ISO 2081 : 1986 (Electro-plated coatings of zinc on iron or steel) or hot dip galvanised according to ISO 1461 : 1973 and ISO 1459 : 1973 (Hot dip galvanisation requirements and guiding principles). Alternatively, the connecting rod may be manufactured from stainless steel Grade 04 Cr 18 Ni 10 conforming to IS 6603:1972.

Note : It is recommended to use stainless steel connecting rods or hot dip galvanised connecting rods where iron content in water exceeds 1 ppm or *p*H value less then 6.5.

It is recommended to use Polytetrafluroethylene (PTFE) tape or equivalent on the riser pipe joints before installation.

5.9 The steel plates, angles and square and round bars shall conform to specifications in Annex A.

5.10 Plunger rod of 12 mm diameter shall conform to Grade 04 Cr 18 Ni 10 of IS 6603:1972.

## 6.0 ANTI-CORROSIVE TREATMENT

### 6.1 *Electrogalvanising*

6.1.1 The following shall be electrogalvanised and passivated conforming to ISO 2081 : 1986.

a) Connecting Rod, and
b) Bearing Spacer

6.1.2 All bolts, nuts and washers in the assembly except high tensile bolts shall be electrogalvanised and passivated conforming to ISO 2081 : 1986.

### 6.2 *Hot dip Galvanising*

6.2.1 The following assemblies or parts shall be hot dip galvanised according to ISO 1461 : 1973 and ISO 1459 : 1973 (Hot dip galvanisation requirements and guiding principles).

a) Head Assembly
b) Front Cover
c) Third Plate
d) Handle Assembly
e) Water tank assembly, and
f) Stand assembly.

6.2.2 The galvanised assemblies shall be given Chromate conversion coating type C as per ISO 3613 : 1980 and ISO 4520 : 1981 (Chromate conversion coatings).

6.3 ***Painting***

The exterior surfaces of cast iron components shall be given the following treatment

a) One coat of red-oxide primer.
b) Two coats of synthetic enamel paint.

6.4 Chain assembly shall be boiled in graphite grease for better anti-corrosion.

7.0 **SAMPLING AND TESTING**

7.1 ***Sampling***

The procedure given in ISO 2859 (part 1) : 1989 shall be followed for sampling inspection. For the characteristics given under 7.2, the Single Sampling Plan with General Inspection Level I and AQL of one percent as given in Tables I and IIA of ISO 2859(Part 1):1989 shall be followed.

7.2 ***Visual and Dimensional Tests***

7.2.1 All the pumps shall be examined for finish and visual defects.

7.2.2 All critical dimensions of the assemblies shall be checked for conformance with figures.

7.2.3 The handle shall have reasonably good surface contact with the top and bottom portions of the bracket.

7.2.4 Riser pipe holder shall be checked for verticality. Plain round mandrel of 300 mm length shall be screwed to the water tank coupling and the verticality shall be checked with a try square. For the entire length of the mandrel a maximum of 1 mm tilt may be allowed.

7.2.5 The flanges shall be reasonably flat to provide proper matching of the holes to ensure unrestricted insertion of the bolts.

7.2.6 After putting the pump on perfect level over a platform, alignment of the rod with respect to the guide bush shall be checked as given below.

7.2.6.1 A rod of 100 mm length and 12 mm diameter shall be fitted to the chain coupling. The handle shall be raised and lowered gently. The rod shall pass through the guide bush freely.

7.2.6.2 The handle shall be checked for lateral play at the end of the square section of the handle and shall not exceed 2 mm on either side.

7.2.6.3 The clearance between the handle and the bracket shall not be less than 1.0 mm.

7.2.7 The stroke of the pump shall be 125 ± 5mm.

7.2.8 The connecting rod and plunger rod shall be examined for straightness and the formation of the threads. The hexagonal coupler shall also be subjected to similar checks. The hexagonal coupler shall be stress relieved before welding to avoid cracks since these are manufactured from cold drawn bars.

7.2.9 The manufacturer shall produce test certificates of all the raw materials of the components, if specified in the contract.

7.2.10 When the pump head has been assembled with the handle, it shall be possible to insert the handle axle using a soft hammer. The fitment of the bearing shall be checked to ensure that the outer race of the bearing does not move when a mild force is applied on the inner race of the bearing and the inner race shall rotate freely.

7.2.11 The cylinder assembly shall be checked for leakage of water. The cylinder shall be filled with water and the water level checked after five minutes. There shall be no evidence of leakage.

7.2.12 The check valve and plunger valve shall move freely after assembly.

7.3 ***Routine Tests***

Out of every batchof 100 pumps, two complete pumps shall be selected and subjected to the following tests in addition to the tests in 7.2

7.3.1 One of the pumps including its cylinder assembly shall be dismantled and all the components checked in detail for critical dimensions conforming to the drawings.

7.3.2 The cylinder assembly of the second pump shall be placed fully submerged in a barrel of water of minimum capacity 200 litres. The pump shall be primed and testing shall commence when there is continuous flow of water through the spout. Water shall be collected in a calibrated container for 40 continuous strokes per minute and the discharge thus measured shall not be less than 15.0 litres.

7.4 ***Criteria for Conformity***

The lot shall be considered conforming to the requirements of this specification if the pumps selected according to 7.1 and 7.2 satisfy the following requirements

a) The number of pumps not meeting the requirements of a characteristic inspected under 7.2 does not exceed the corresponding acceptance number as specified in ISO 2859 (part 1) : 1989.

b) The pumps selected according to 7.3 meet the requirements as given in 7.3.1 and 7.3.2.

## 8.0 GUARANTEE

The pump and accessories, excepting rubber components, shall be guaranteed for 12 months from the date of installation or 18 months from the date of supply whichever is earlier, against bad workmanship and bad materials.

## 9.0 MARKINGS

9.1 The pumphead, cylinder and connecting rod shall be marked as under.

9.1.1 The pumphead shall have a name plate with the name of the manufacturer and serial number of the pumphead assembly. In addition the top flange, cover plate and the stand assembly flange shall have steel punch impressions of the manufacturer's identification mark before galvanising. The impressions shall be deep enough so that they shall not be covered by the galvanisation.

9.1.2 The cylinder body shall have the manufacturer's identification mark in raised letters. The serial number shall be marked on the cylinder by steel punch.

9.1.3 The connecting rods shall have steel punch impressions indicating the manufacturer's identity and year of manufacture.

## 10.0 *Packing*

10.1 The connecting rods and plunger rod shall be fitted with high density polyethylene (HDPE) thread protectors at ends before despatch.

## ----------Shallow Well Handpump Specifications--

| Fig No. | QTY | DESCRIPTION | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 2a | 1 | Head | 4mm M.S.Plate | ST.37 |
| 2d | 1 | Bracket/Window | 4mm M.S.Plate | ST.37 |
| 2h | 1 | Front Bottom End Plate | 4mm M.S.Plate | ST.37 |
| 2i | 2 | Gusset | M.S.Triangular Bar | ST.37 |
| 2j | 1 | Axle Bush (Right) | Dia. 45mm Bar | ST.37 |
| 2k | 1 | Axle Bush (Left) | Dia. 45mm Bar | ST.37 |
| 2l | 1 | Flange | 6mm M.S.Plate | ST.37 |
| 3 | 1 | Front Cover | 2mm M.S.Plate | ST.37 |
| 4a | 1 | Flange | 6mm M.S.Plate | ST.37 |
| 4b | 1 | Guide Bush | Dia. 35mm Bar | ST.37 |
| 5a | 1 | Handle Bar | Square 32mm Bar | ST.37 |
| 5a | 1 | Handle Pipe | 25mm NB Pipe | ST.37 |
| 5c | 1 | Chain Guide | Square 12mm Bar | ST.37 |
| 5e | 1 | Chain Coupling | Dia. 50mm Bar | ST.37 |
| 5f | 1 | Roller Chain | 25.4mm Pitch | - |
| 5g | 1 | Bearing Housing | Square 60mm Bar | ST.37 |
| | | | or Dia. 70mm Bar | ST.37 |
| 6a | 1 | Top Flange | 6mm M.S.Plate | ST.37 |
| 6b | 1 | Bottom Flange | 6mm M.S.Plate | ST.37 |
| 6d | 1 | Tank Pipe | 150mm NB Pipe | ST.37 |
| 6e | 1 | Spout Pipe | 40mm & 25mm NB Pipe | ST.37 |
| 6g | 1 | Riser Pipe Holder | 85x9mm Thick Wall Pipe | ST.37 |
| 6h | 2 | Gusset | 6mm M.S.Plate | ST.37 |
| 7e | 1 | Stand Pipe/150 NB | 150mm NB Pipe | ST.37 |
| 7h | 1 | Stand Pipe/175 NB | 175mm NB Pipe | ST.37 |
| 7m | 1 | Flange Top | 6mm M.S.Plate | ST.37 |
| 7n | 1 | Base Flange | 5mm M.S.Plate | ST.37 |
| 7p | 3 | Legs | 40x40x6mm Angle | ST.37 |
| 7q | 2 | Gusset | 6mm M.S.Plate | ST.37 |
| 7r | 4 | Base Plate Gusset | 4-6mm M.S.Plate | ST.37 |

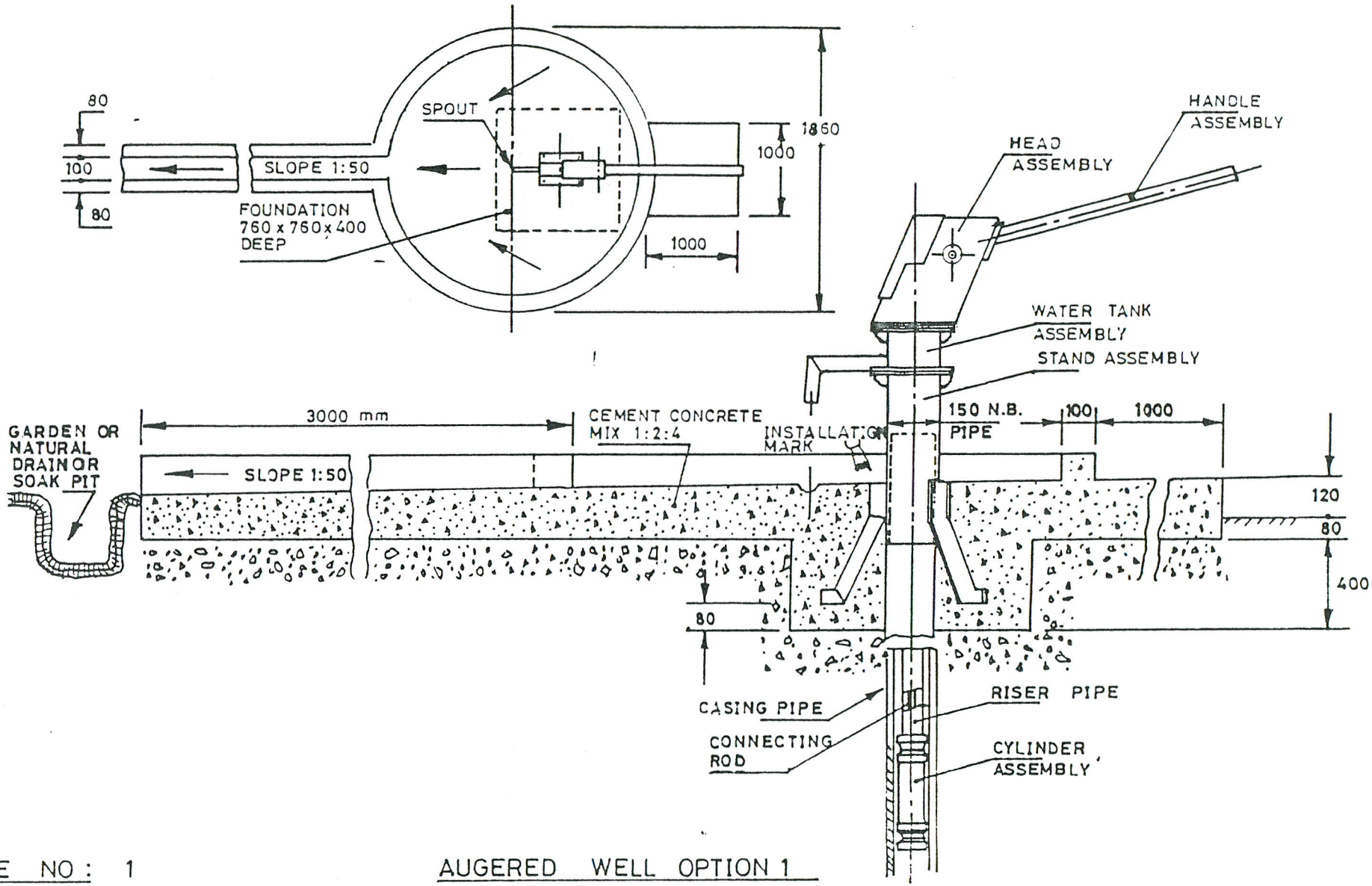



FIGURE NO : 1

AUGERED WELL OPTION 1

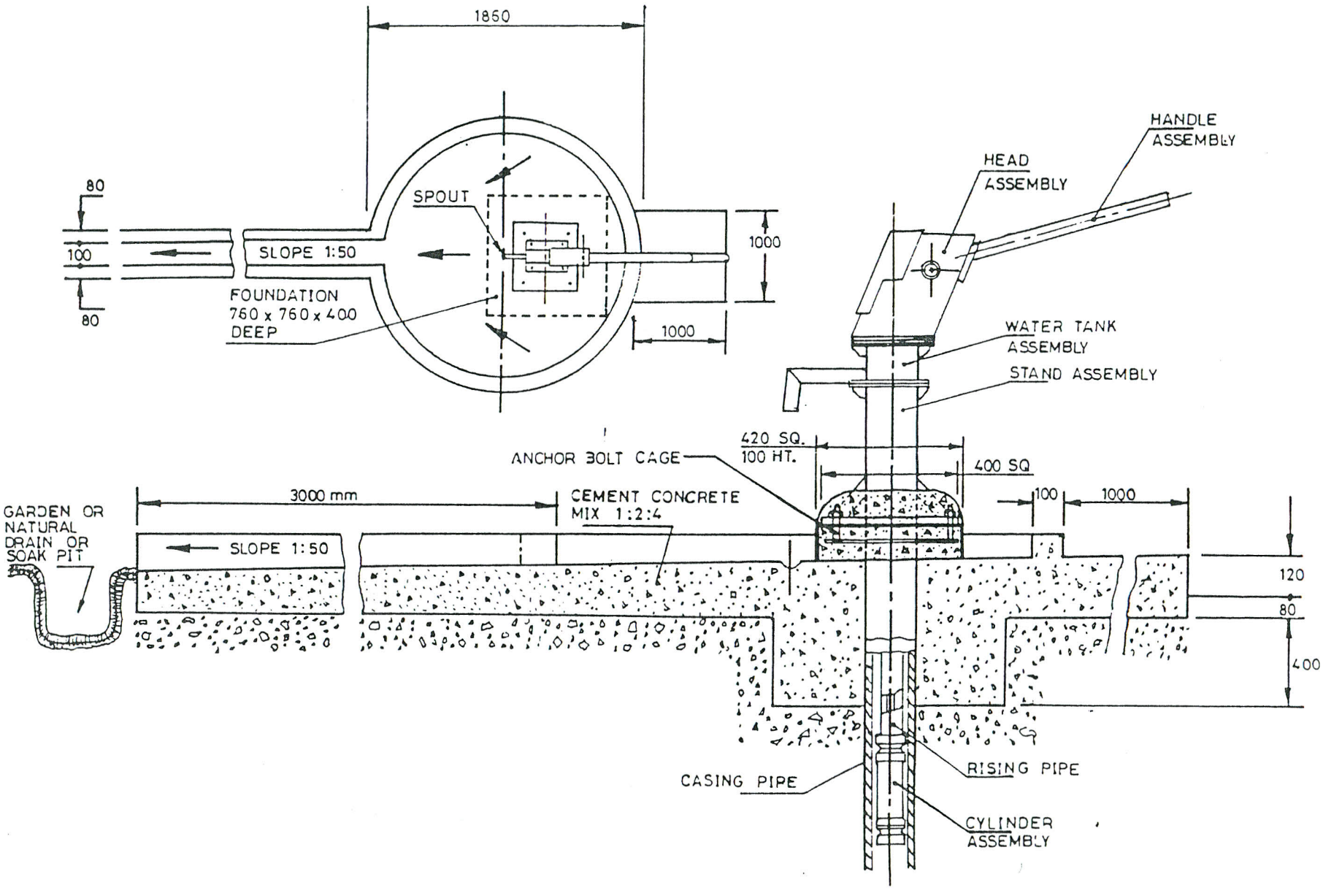
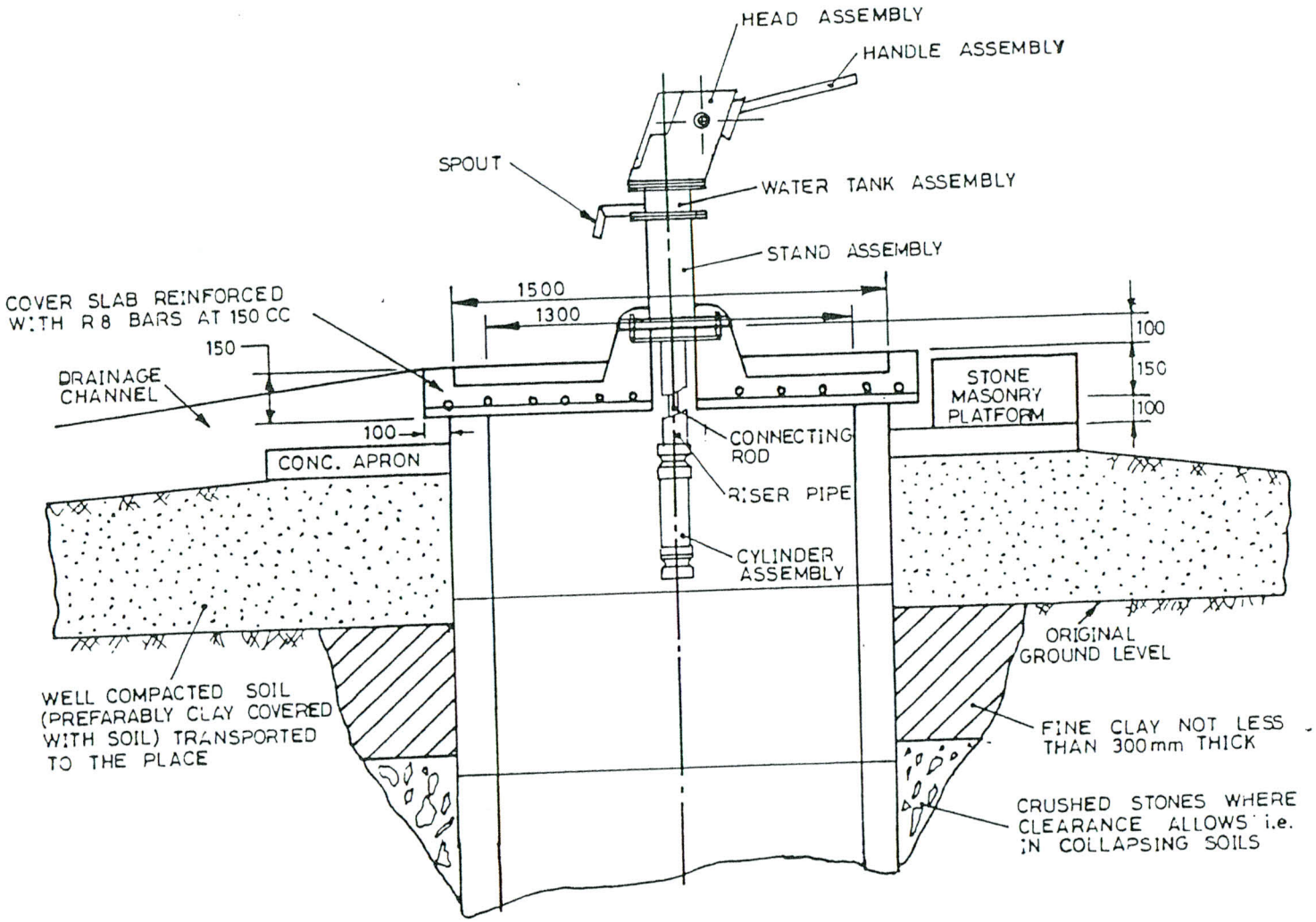



FIGURE NO : 1a

AUGERED WELL OPTION 2




DUG WELL OPTION

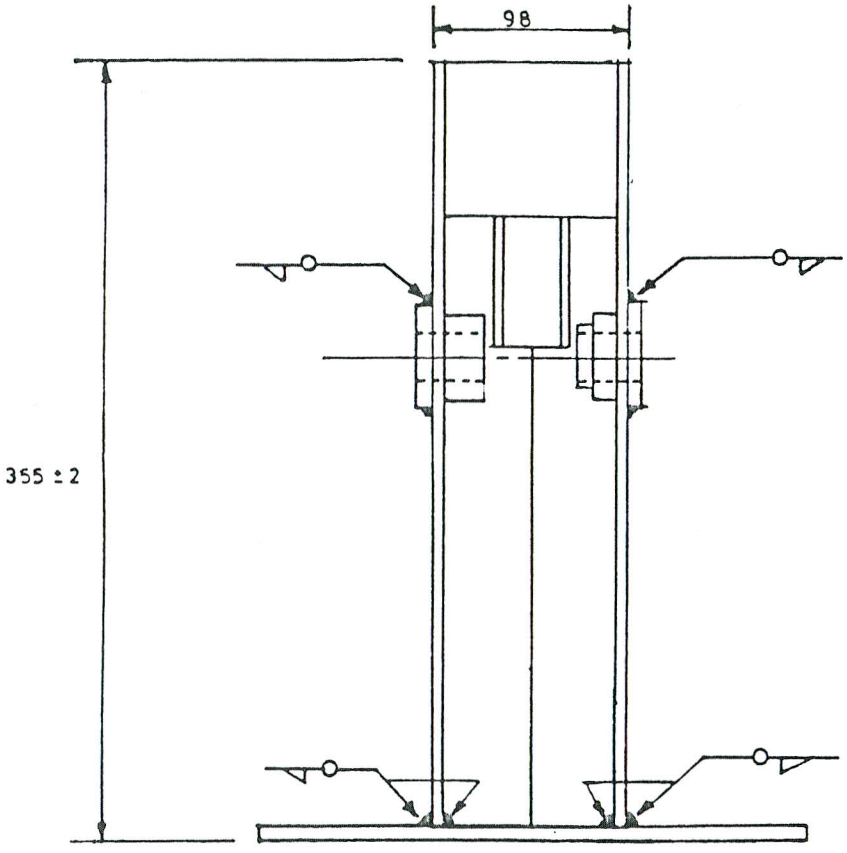
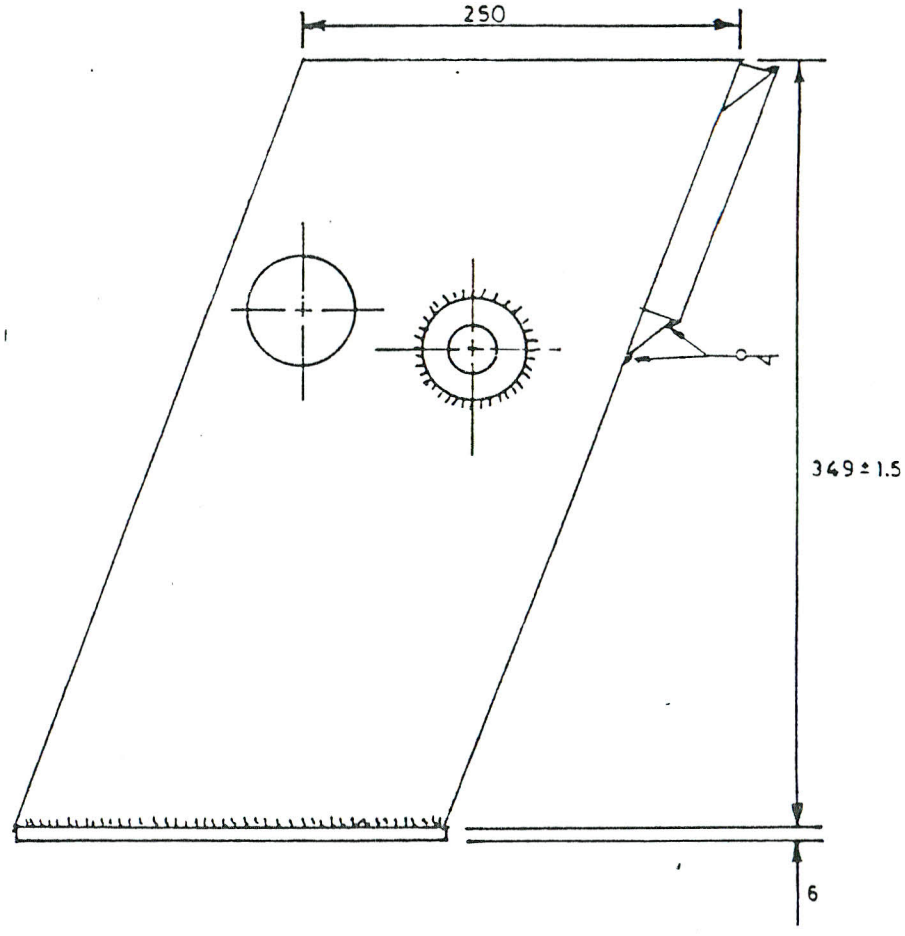
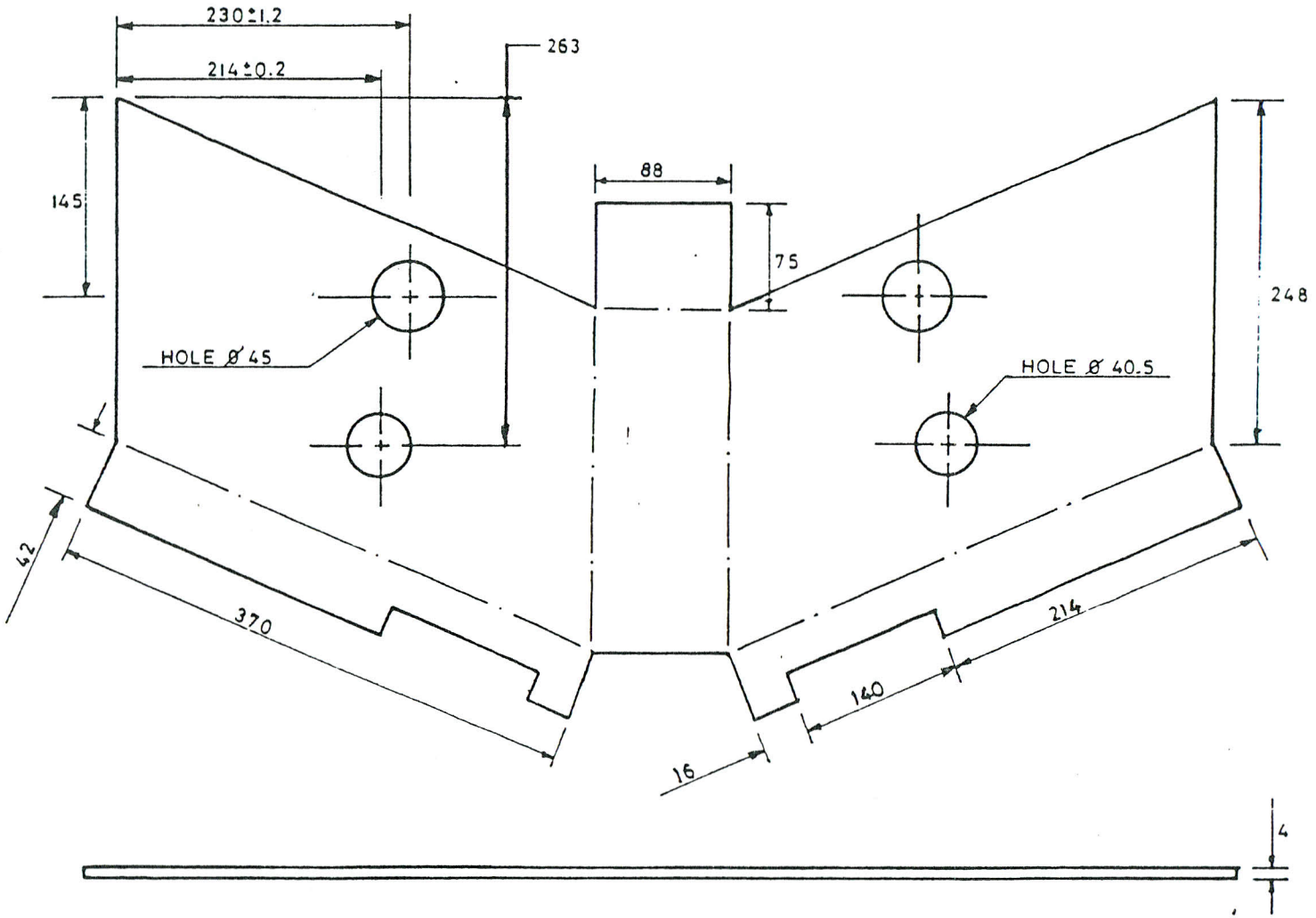



FIGURE NO: 2




HEAD ASSEMBLY



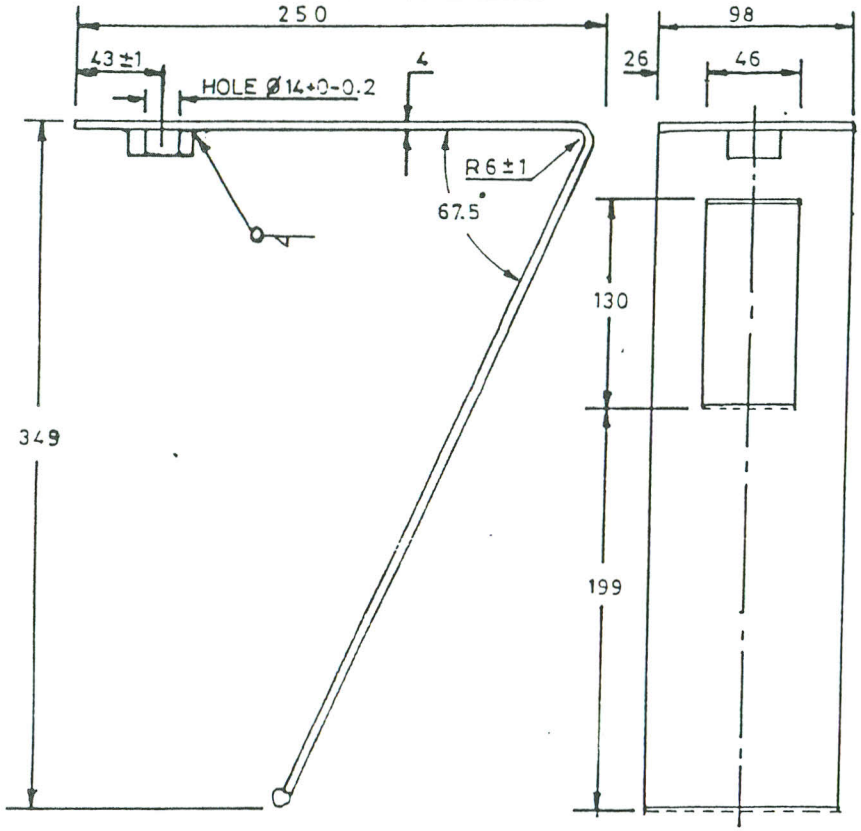

OPTION 1

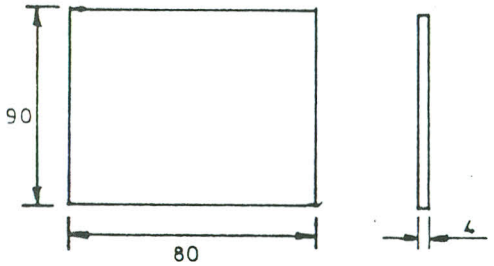
FIGURE NO: 2a

HEAD BEFORE BENDING

Note: —— · —— · —— = LINE OF FOLDING

BACK PLATE




FRONT TOP END PLATE

FIGURE 2c

SIDE PLATE

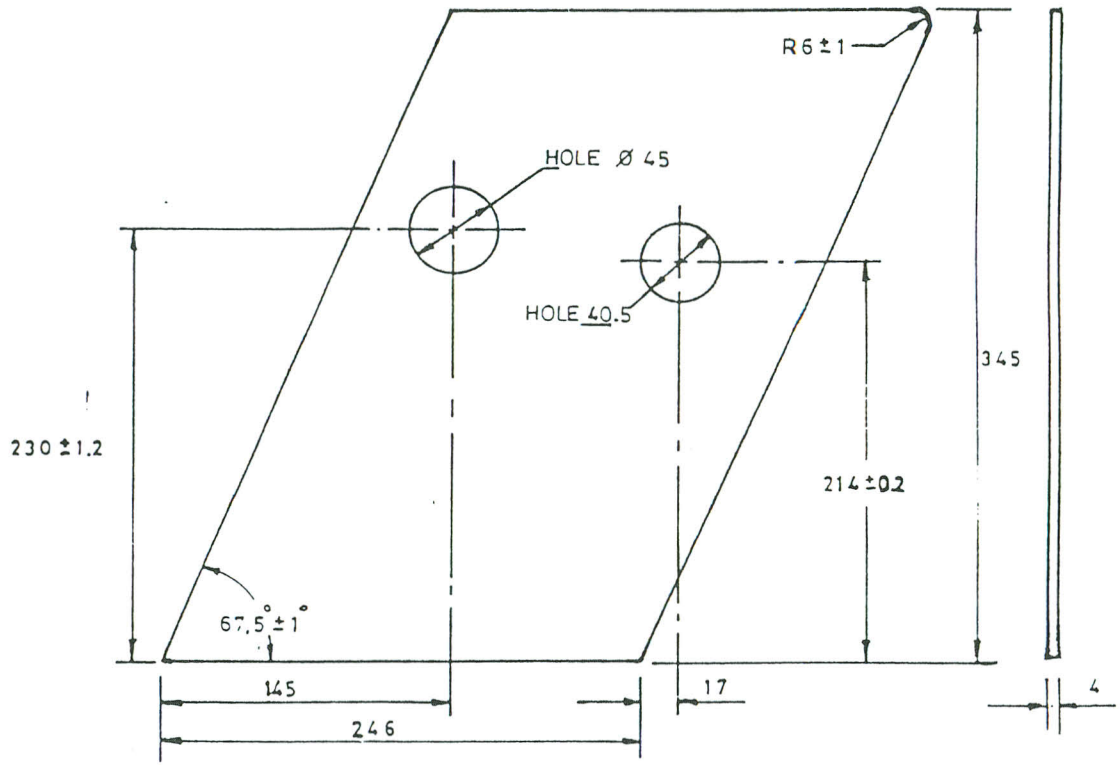



FIGURE 2b

FIGURE NO : 2b & 2c

OPTION 2

HEAD BEFORE ASSEMBLY/WELDING

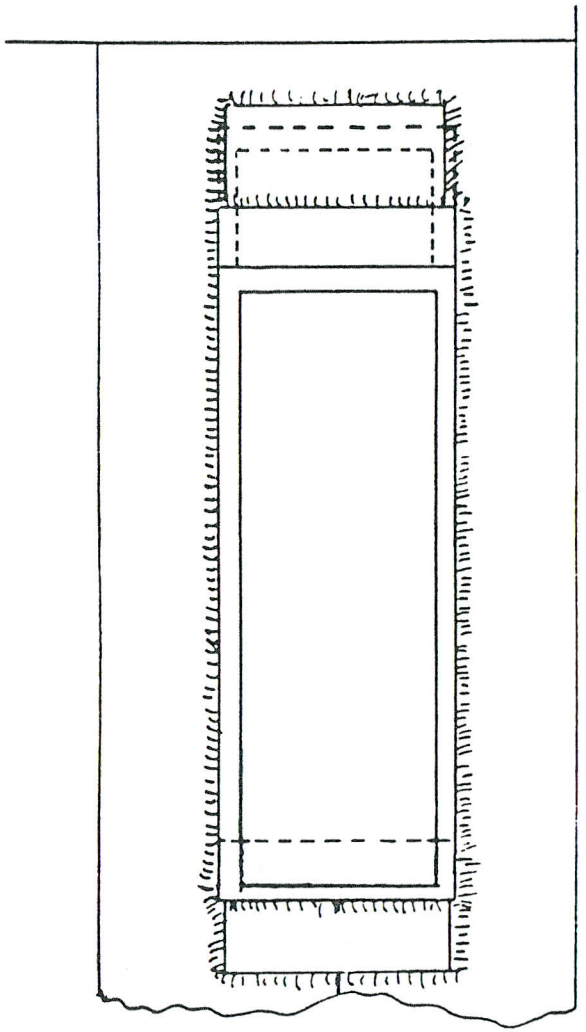
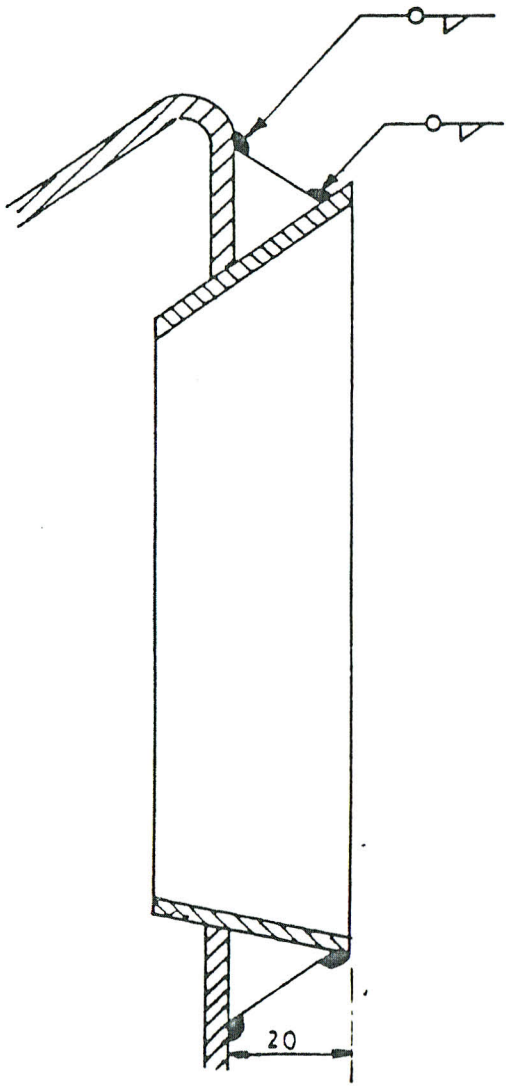


FIGURE NO: 2d




POSITIONING OF BRACKET ON HEAD

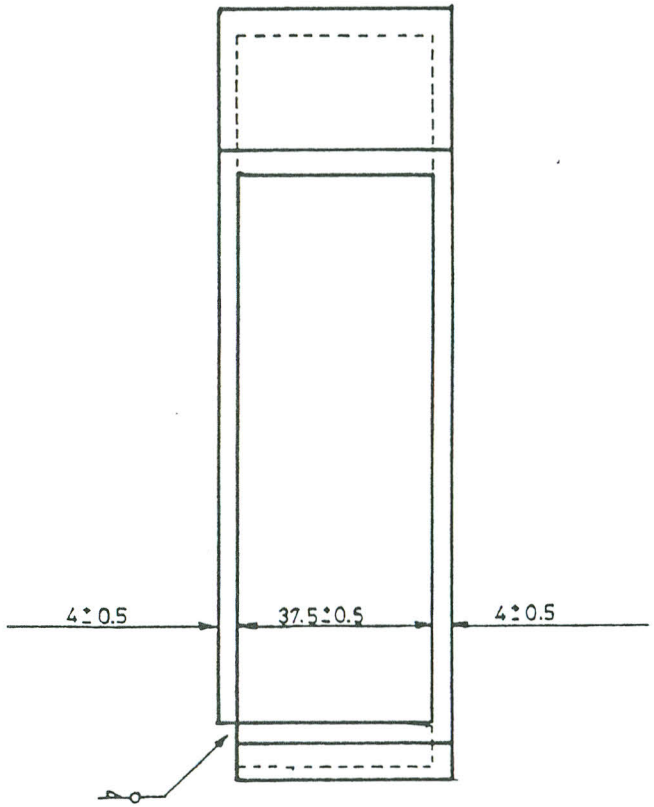
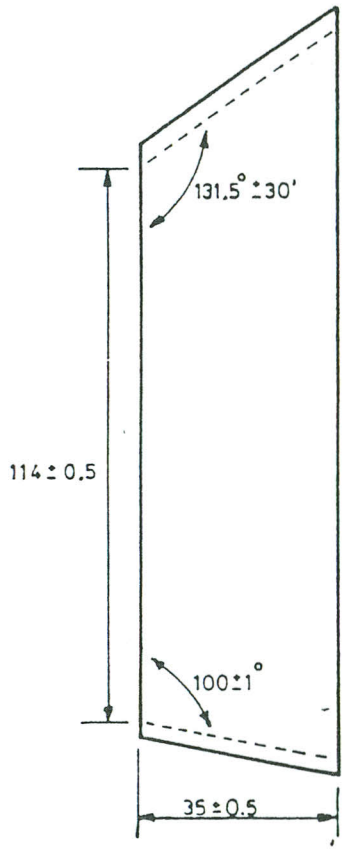



FIGURE NO: 2e




WINDOW OR BRACKET

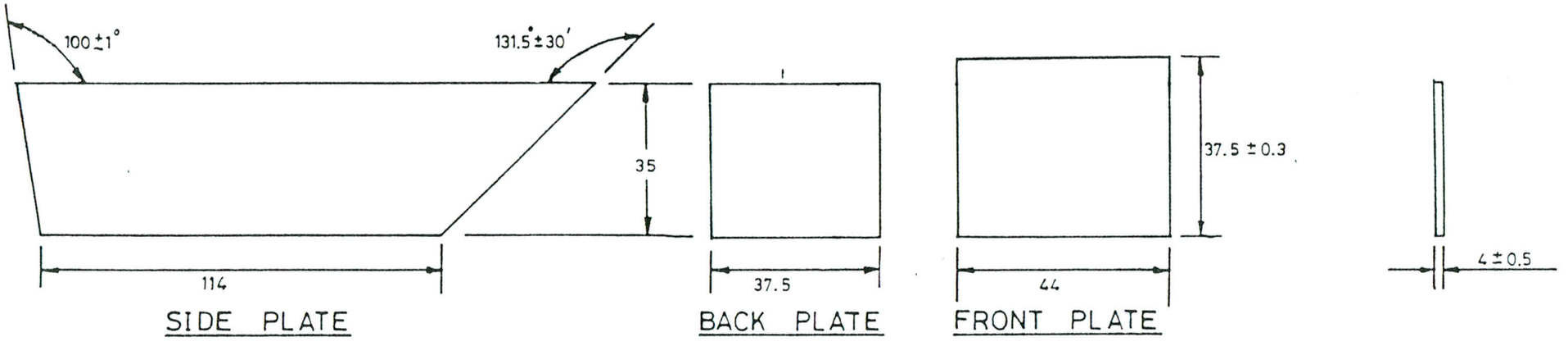
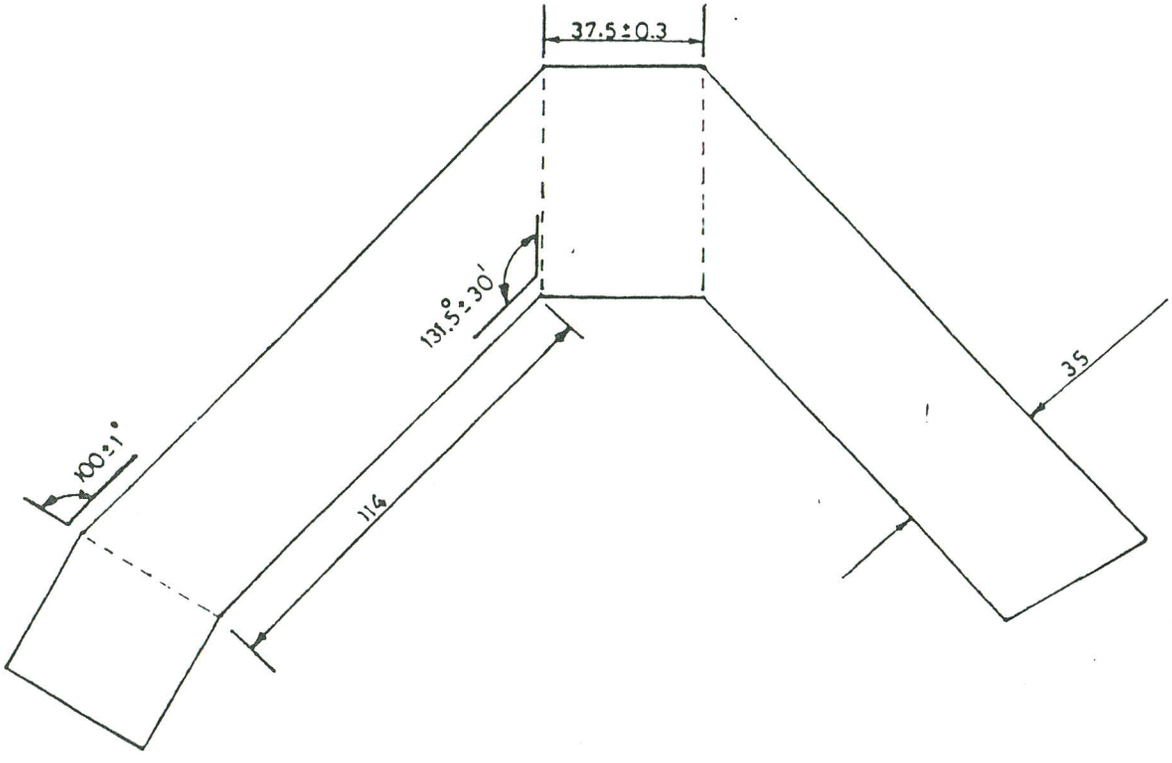



FIGURE NO : 2g

OPTION 2

WINDOW OR



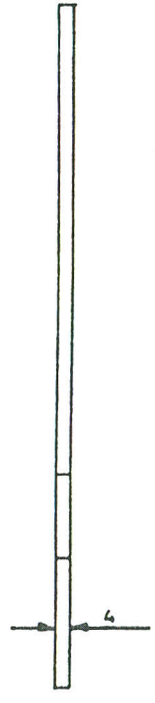




FIGURE NO : 2f

OPTION 1

WINDOW OR BRACKET
BEFORE BENDING

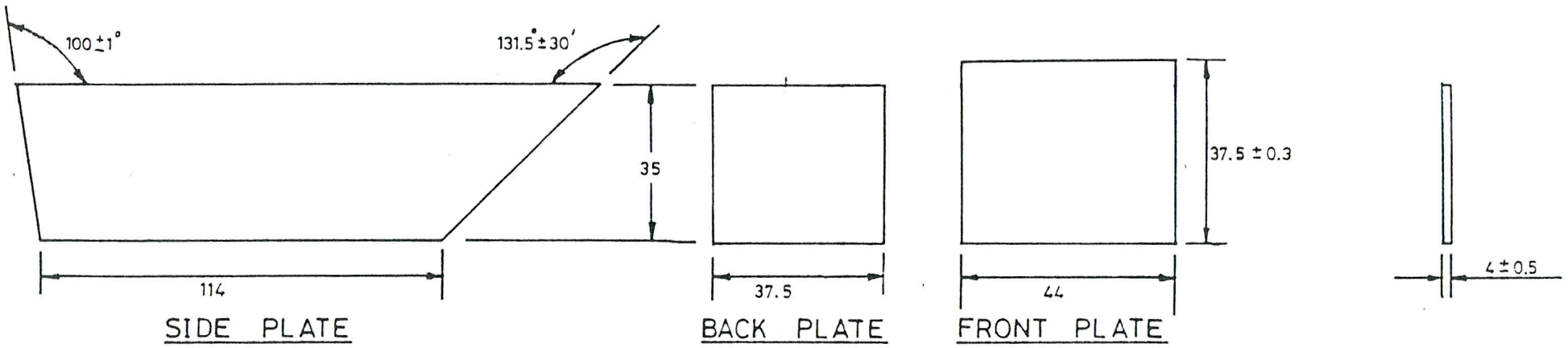



FIGURE NO : 2g

OPTION 2

WINDOW OR BRACKET
BEFORE ASSEMBLY

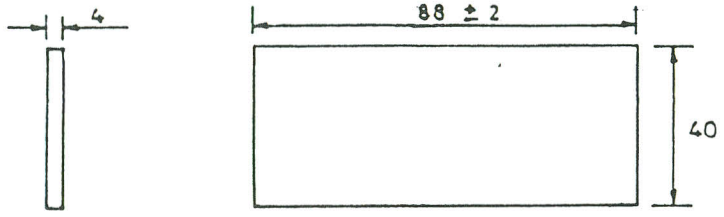



FIGURE 2h
FRONT BOTTOM END PLATE

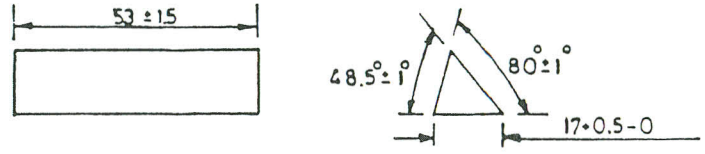



FIGURE 2i
GUSSET

FIGURE NO: 2h & 2i

FRONT BOTTOM END PLATE AND GUSSET

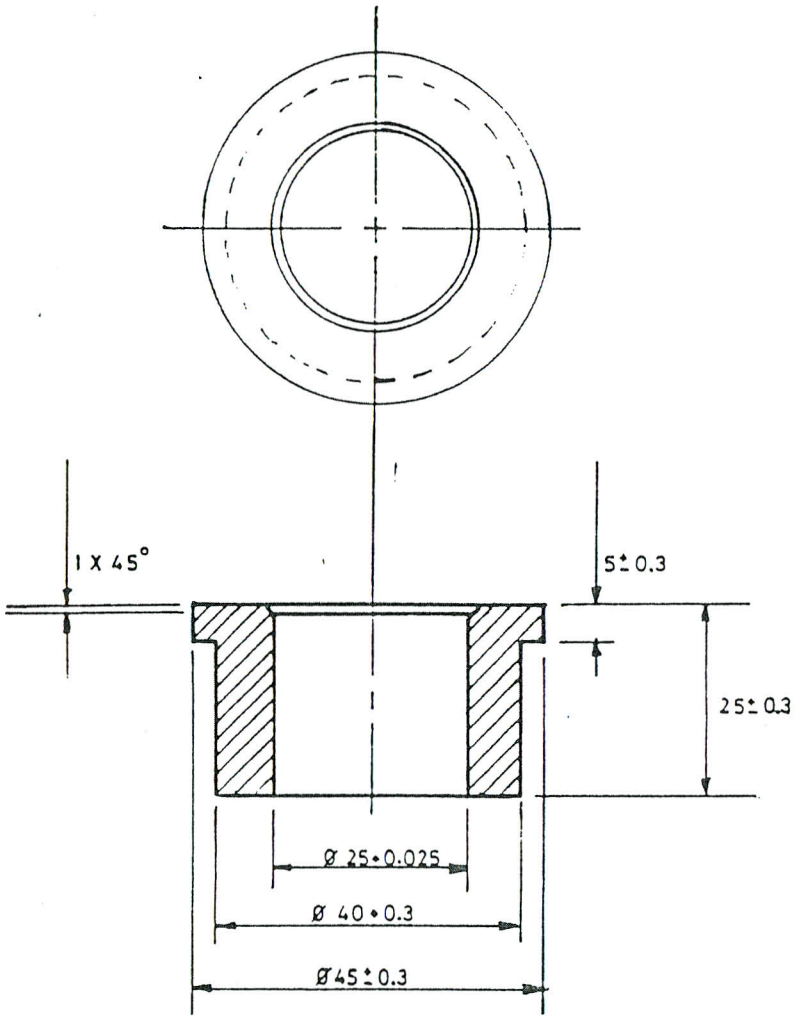



FIGURE NO : 2j

AXLE BUSH (RIGHT)

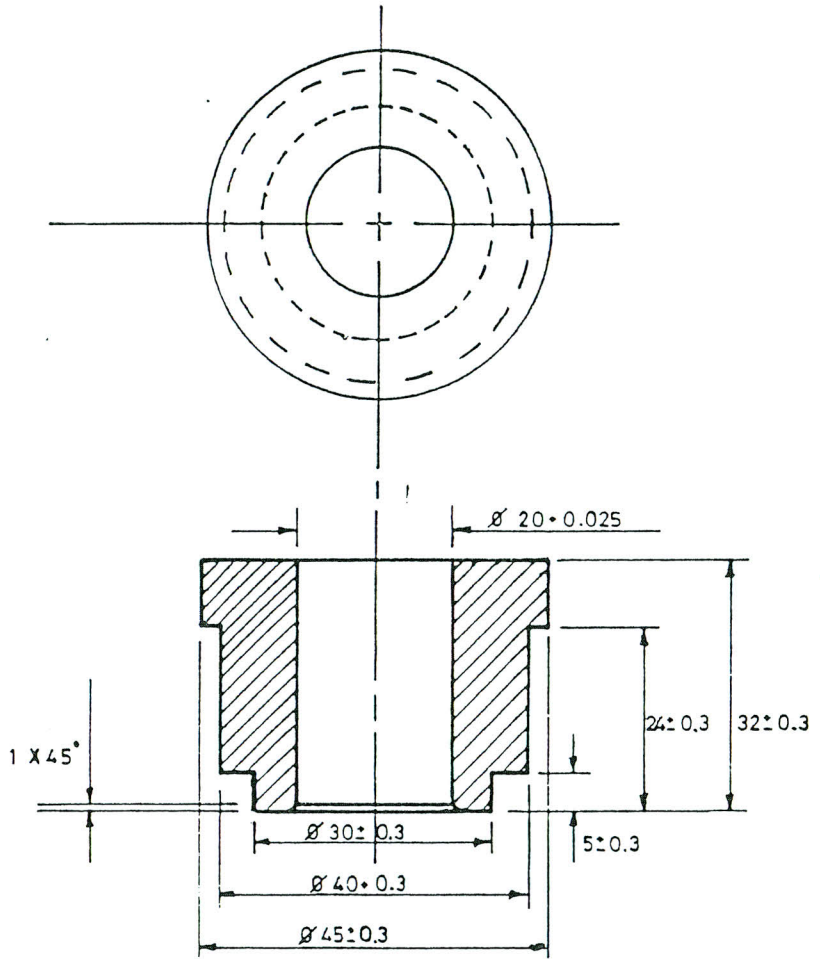



FIGURE NO : 2k

AXLE BUSH (LEFT)

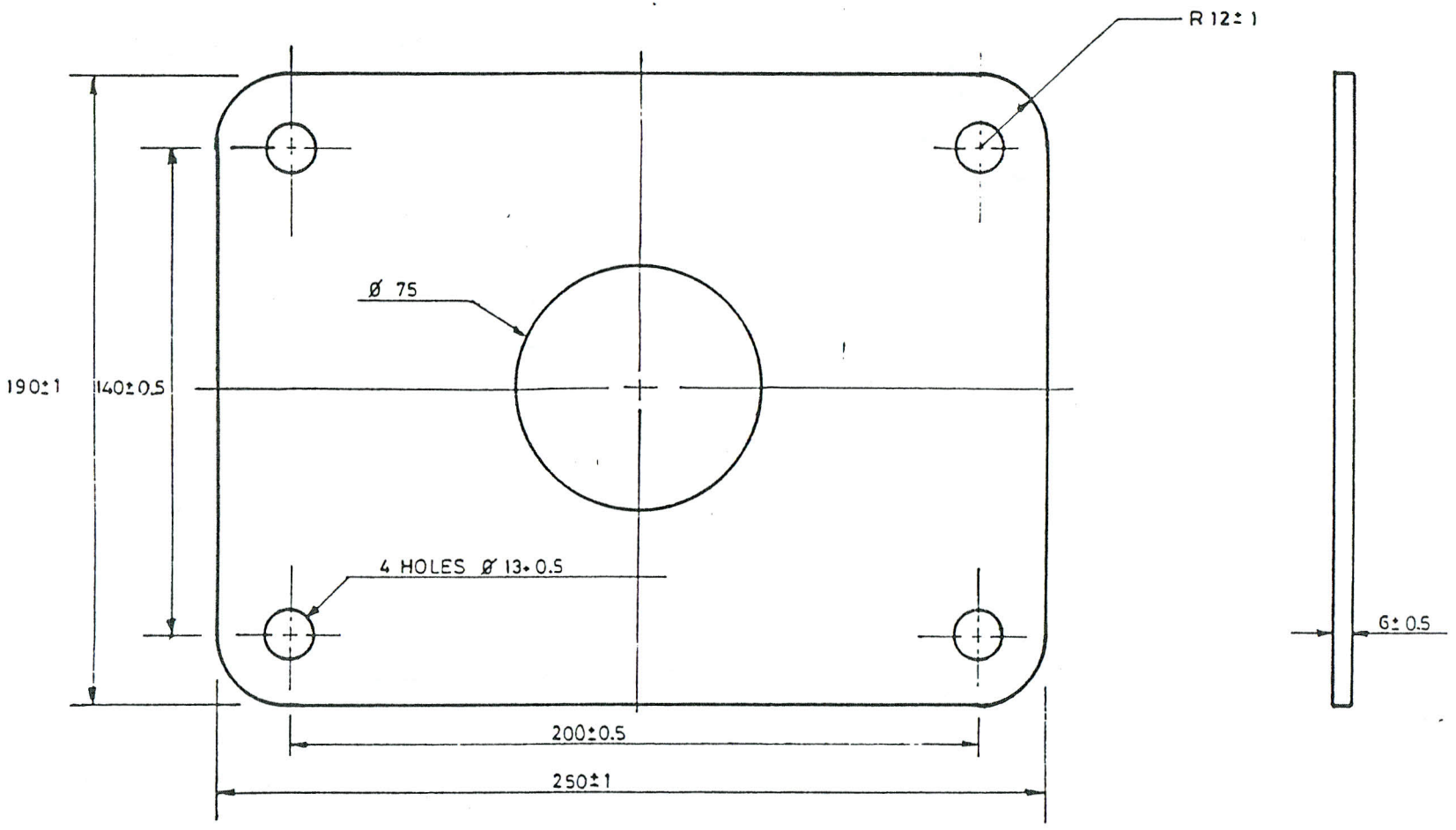
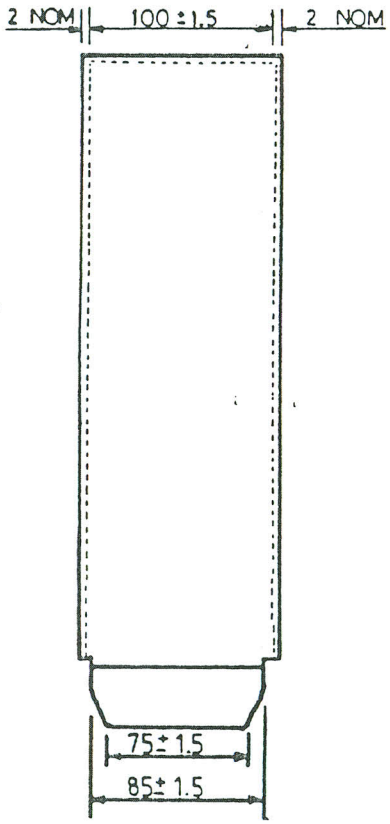



FIGURE NO : 21

HEAD ASSEMBLY FLANGE



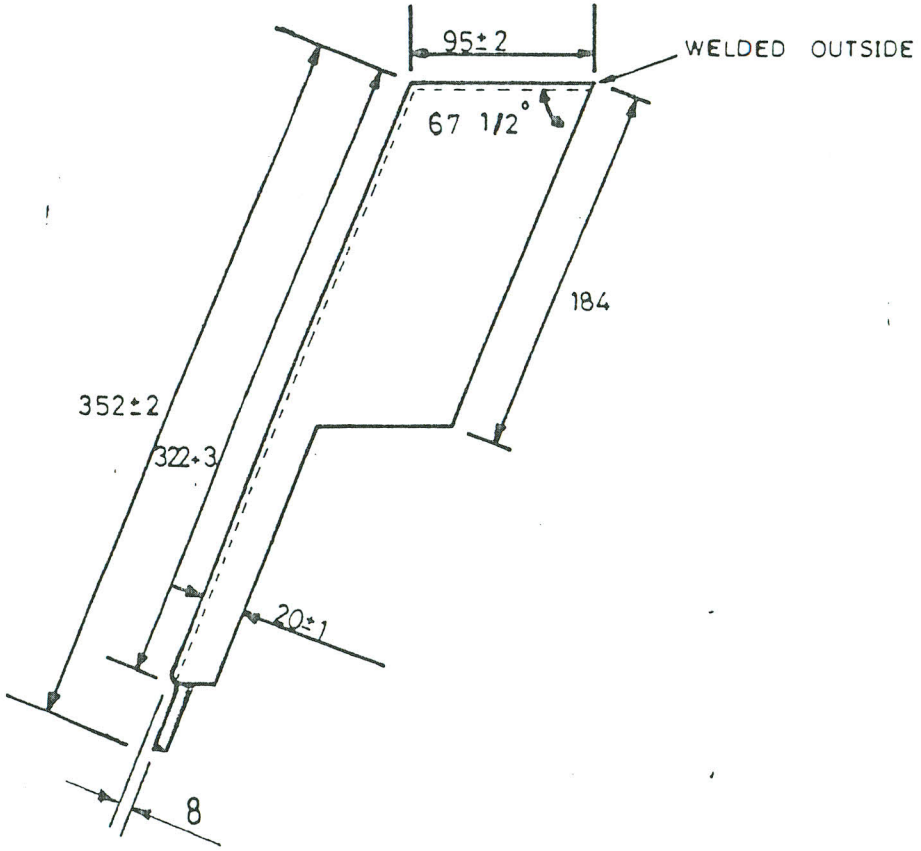




FIGURE NO: 3

FRONT COVER

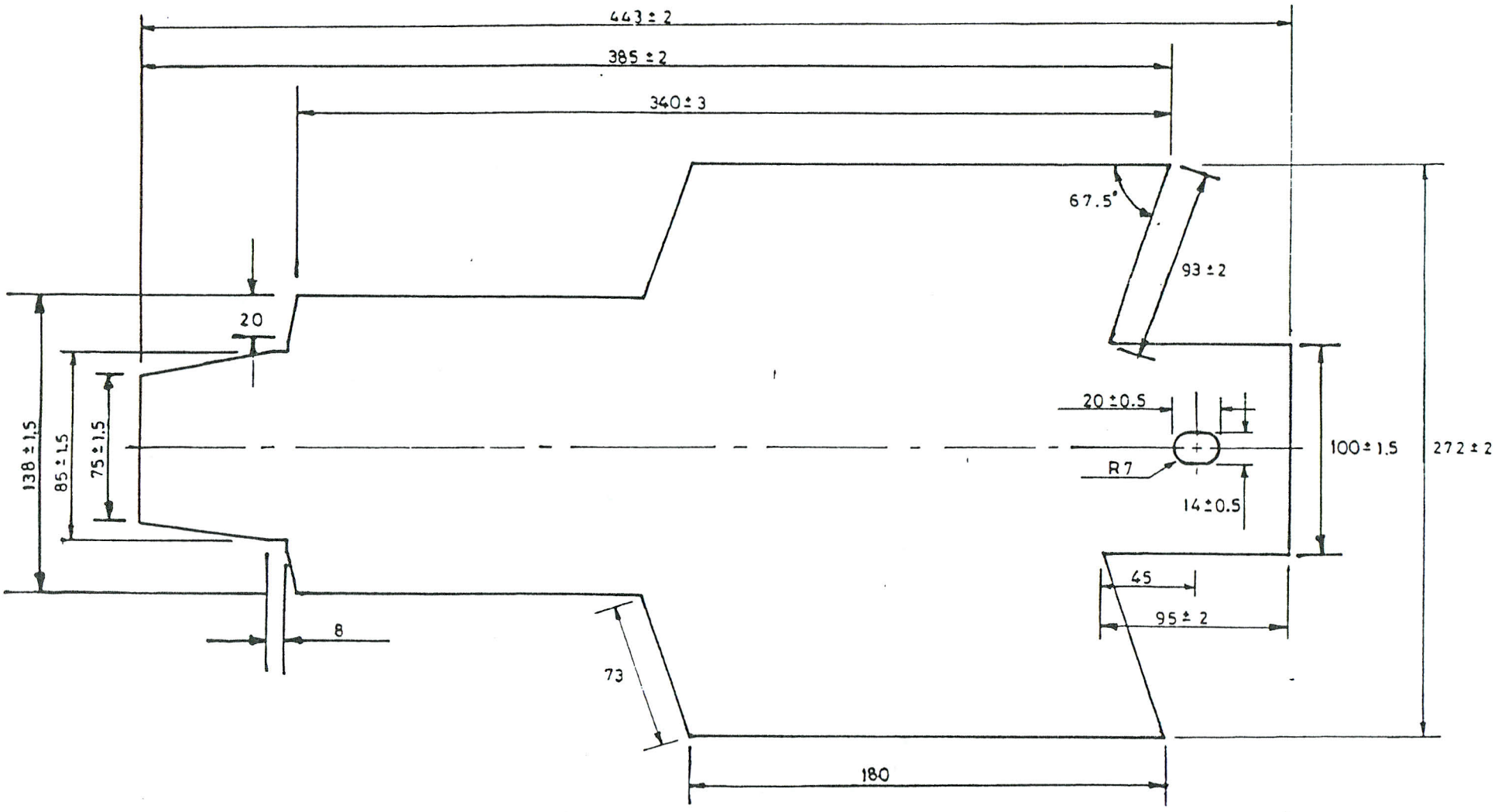



FIGURE NO: 3a

FRONT COVER BEFORE BENDING

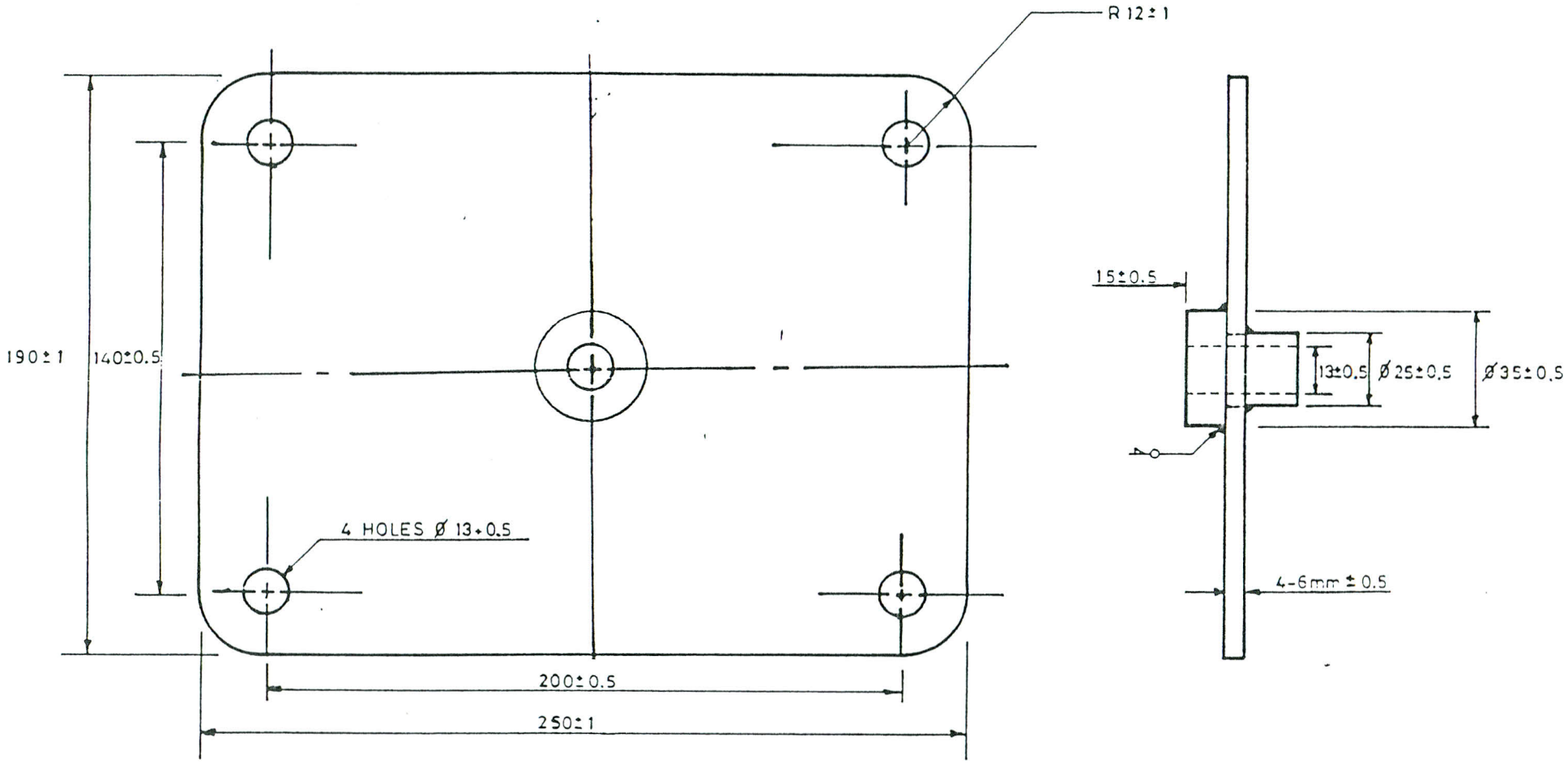



FIGURE NO : 4

THIRD PLATE

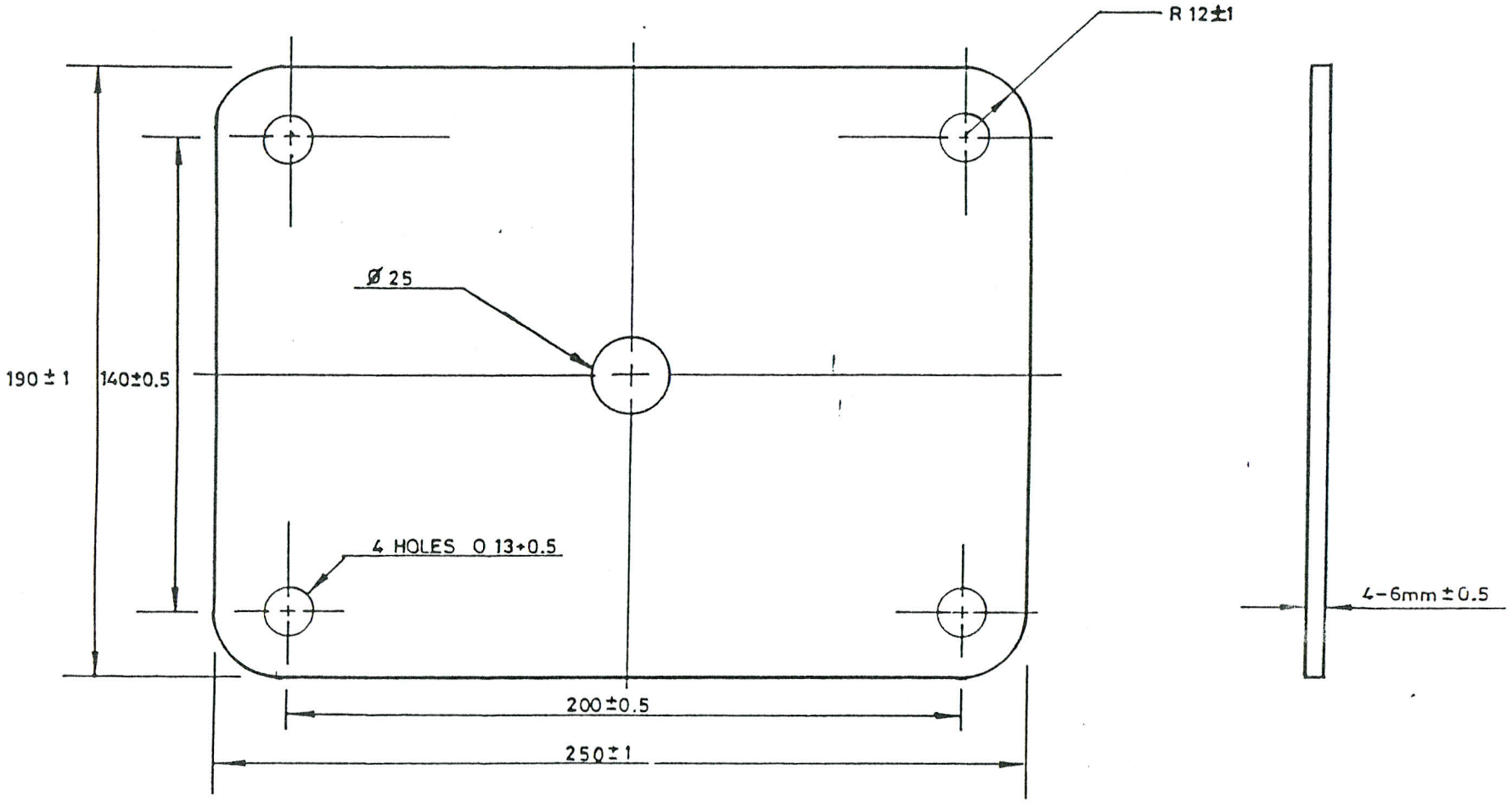
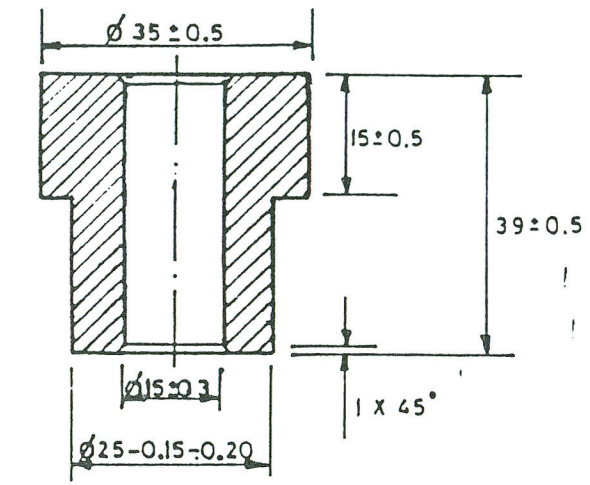
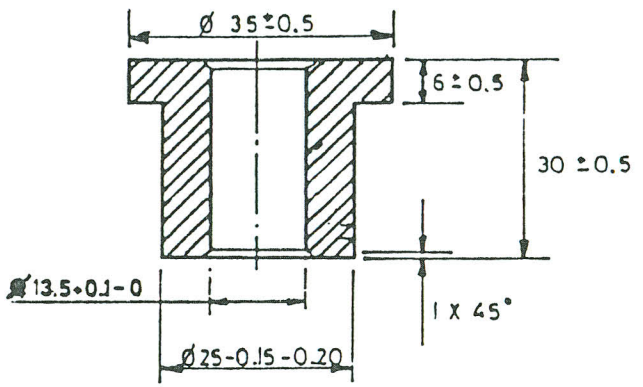



FIGURE NO : 4a

THIRD PLATE FLANGE




OPTION 1




OPTION 2

FIGURE NO: 4b

GUIDE BUSH

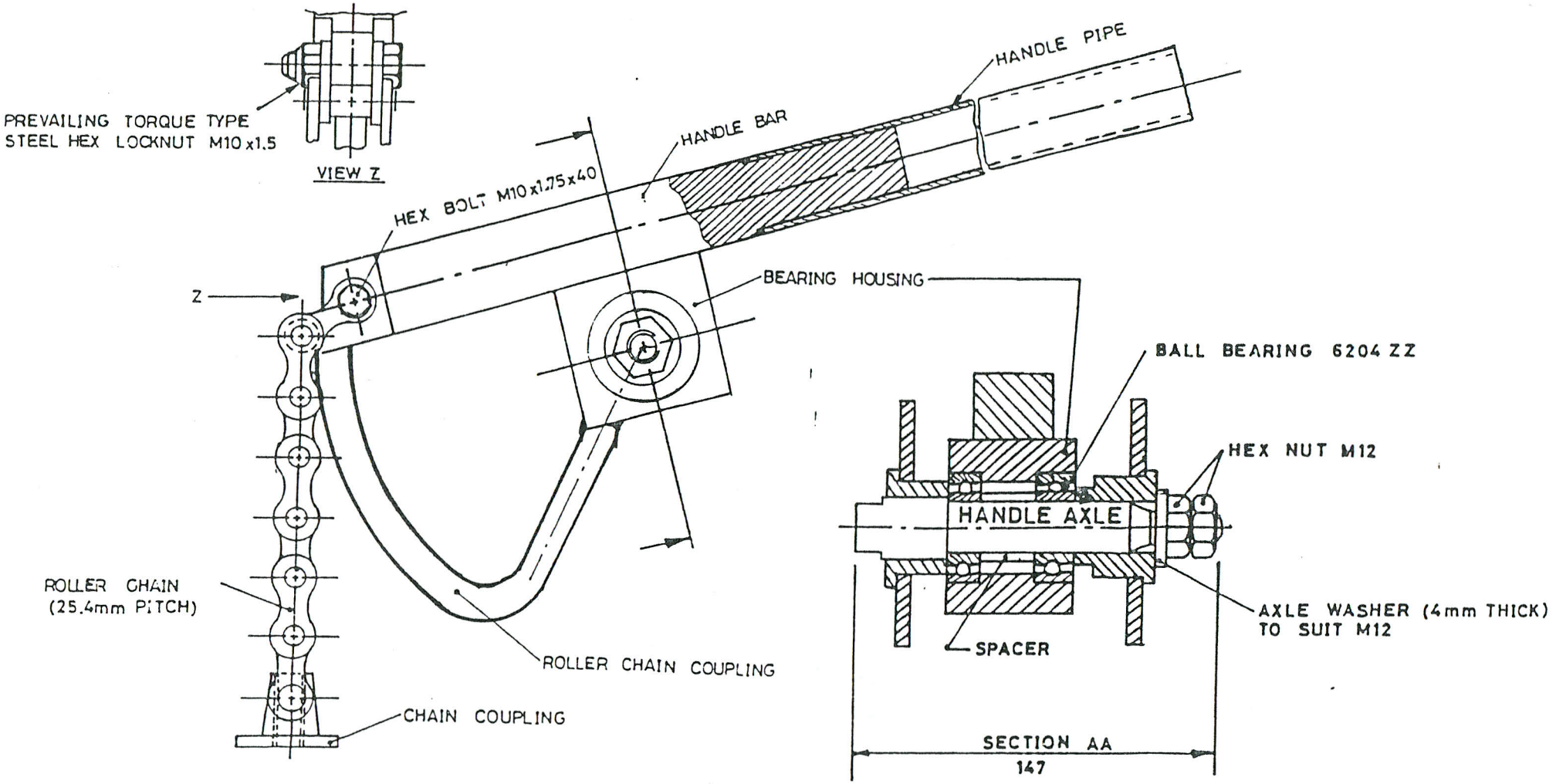
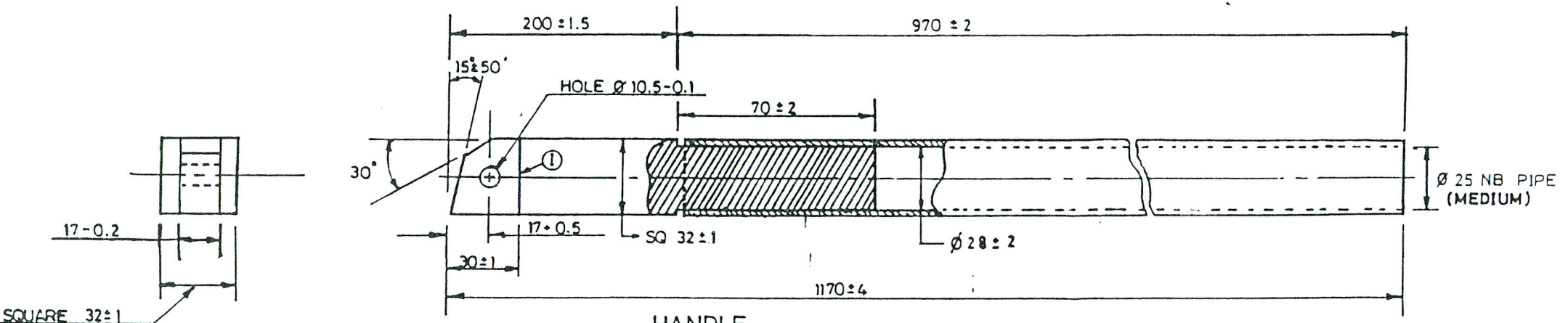



FIGURE NO : 5

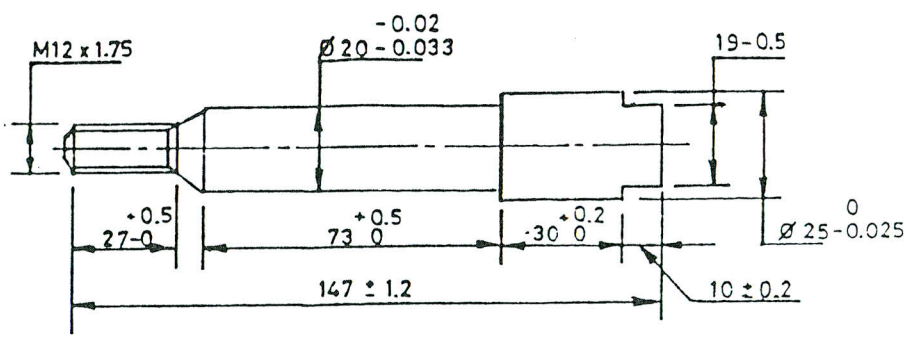
HANDLE ASSEMBLY




HANDLE

FIGURE 5a

① → THIS PORTION CAN BE STRAIGHT OR CAN HAVE ANY RADIUS

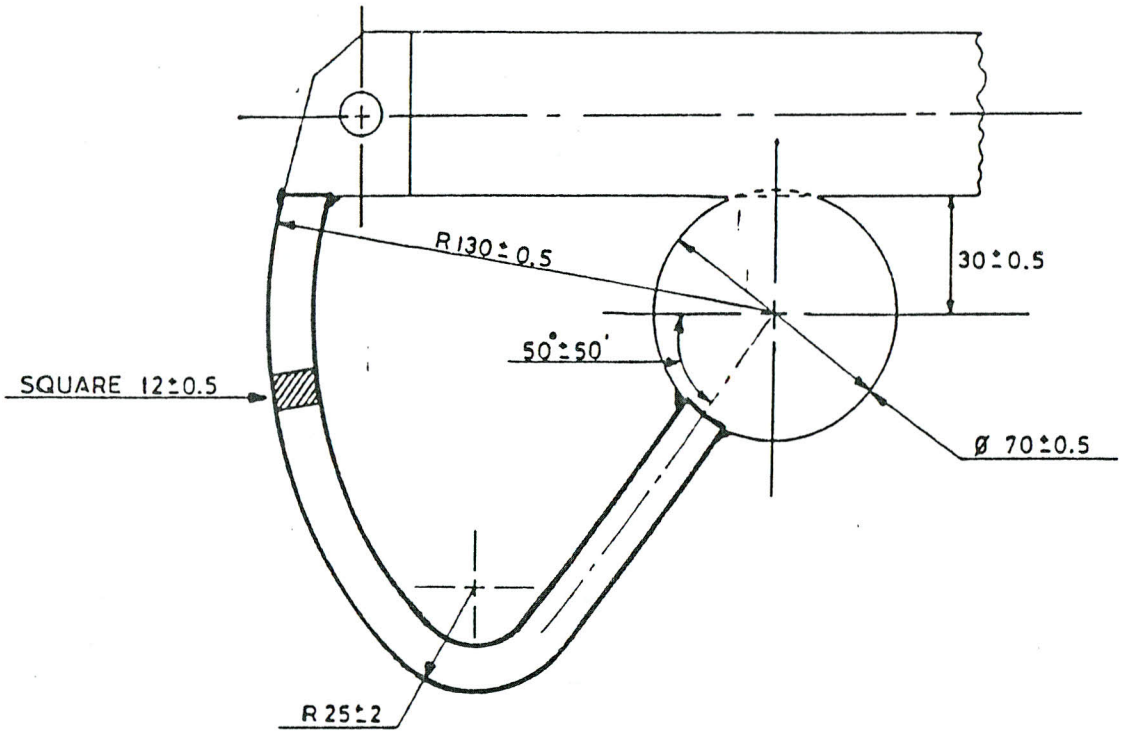



HANDLE AXLE

FIGURE NO 5b

FIGURE NO : 5a & 5b

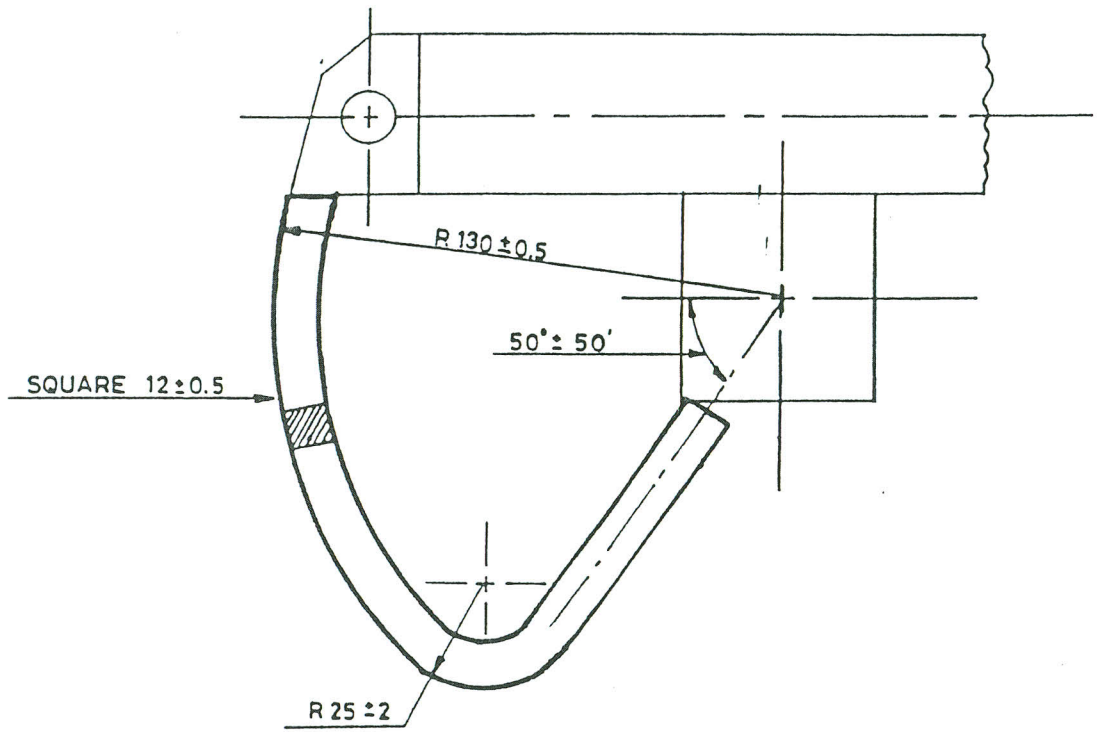
SHALLOW HANDLE




OPTION 1

FIGURE NO: 5c

CHAIN GUIDE




OPTION 2

FIGURE NO : 5d

CHAIN GUIDE

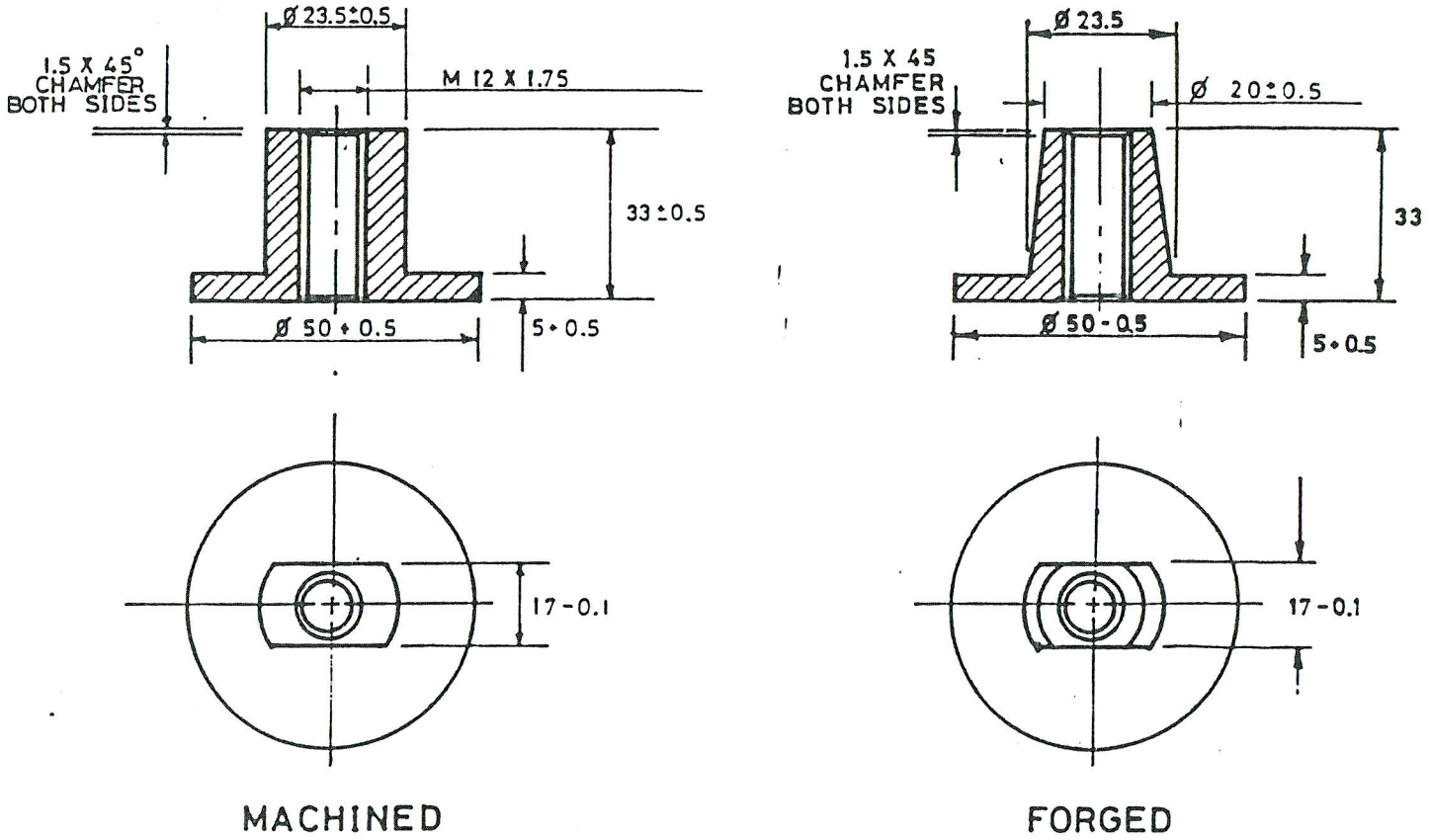



FIGURE NO: 5e

CHAIN COUPLING

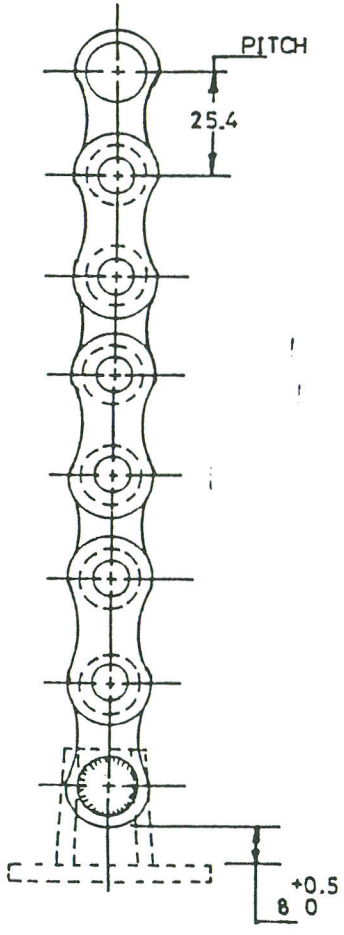



FIGURE NO : 5f

ROLLER CHAIN

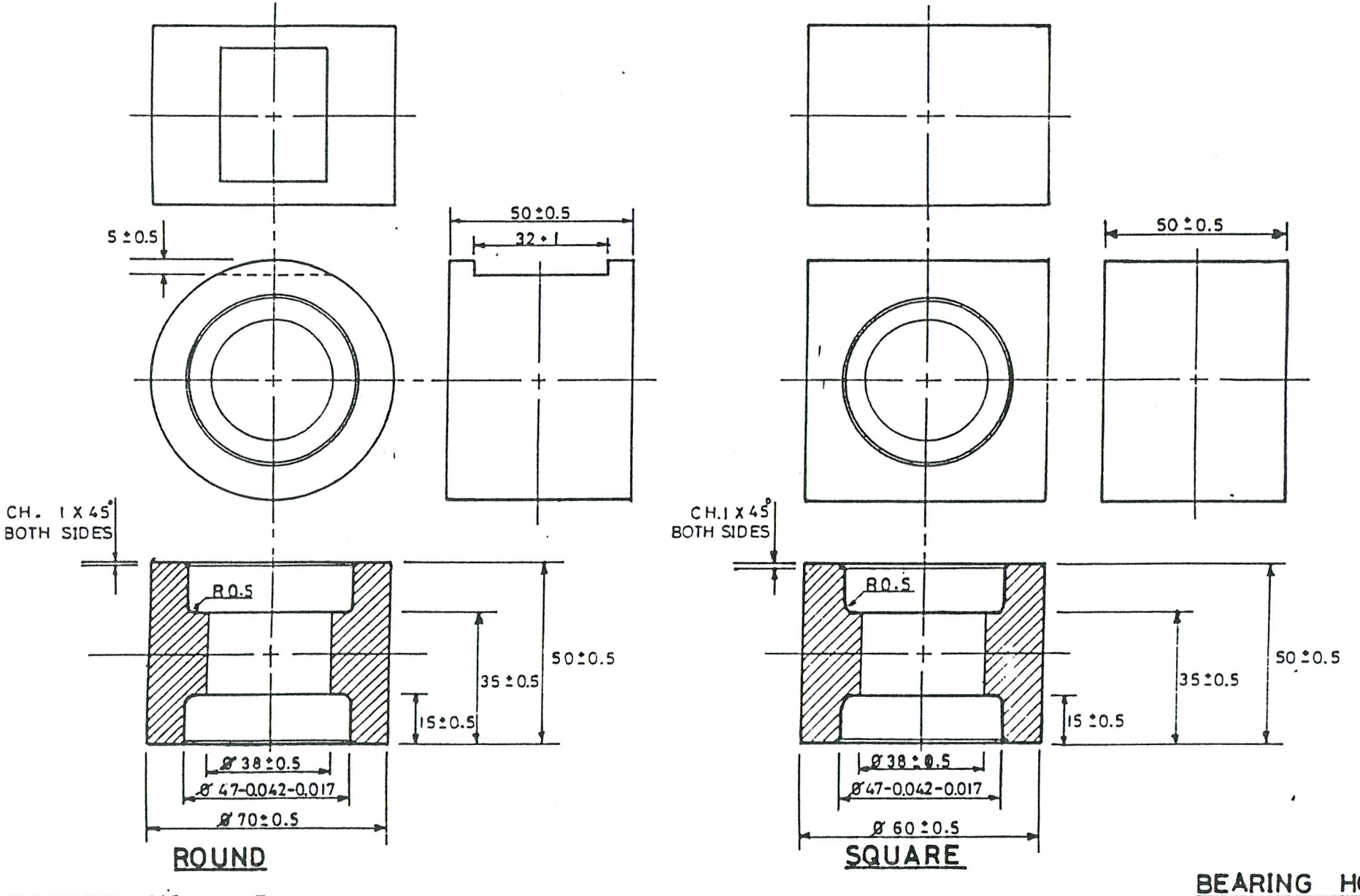



FIGURE NO : 5g

BEARING HOUSING

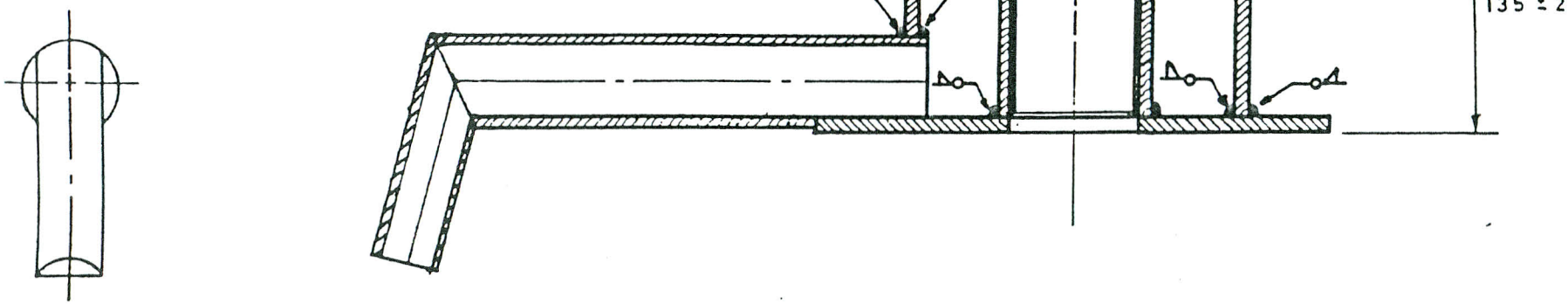



FIGURE NO: 6

WATER TANK ASSEMBLY

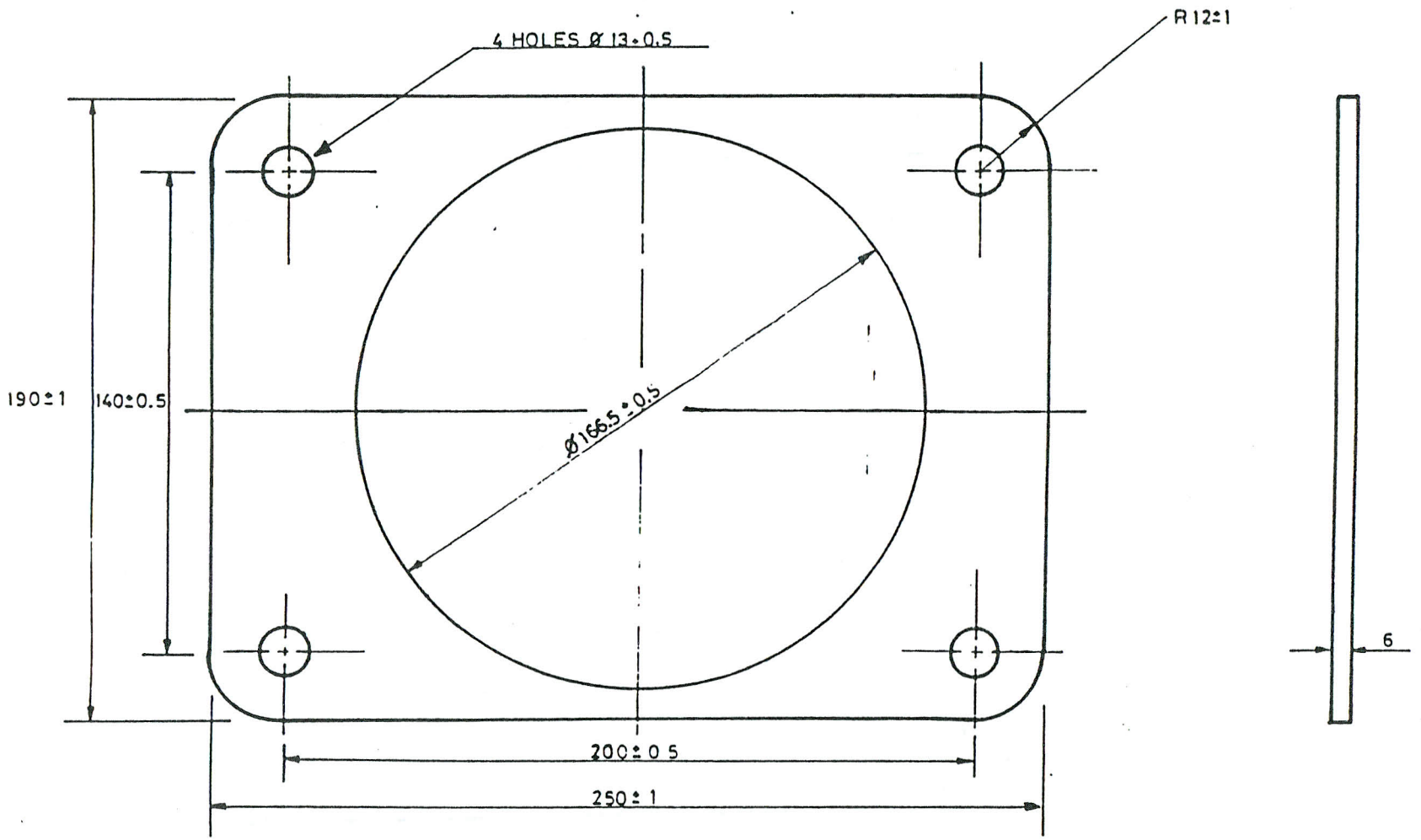



FIGURE NO: 6a

WATER TANK TOP FLANGE

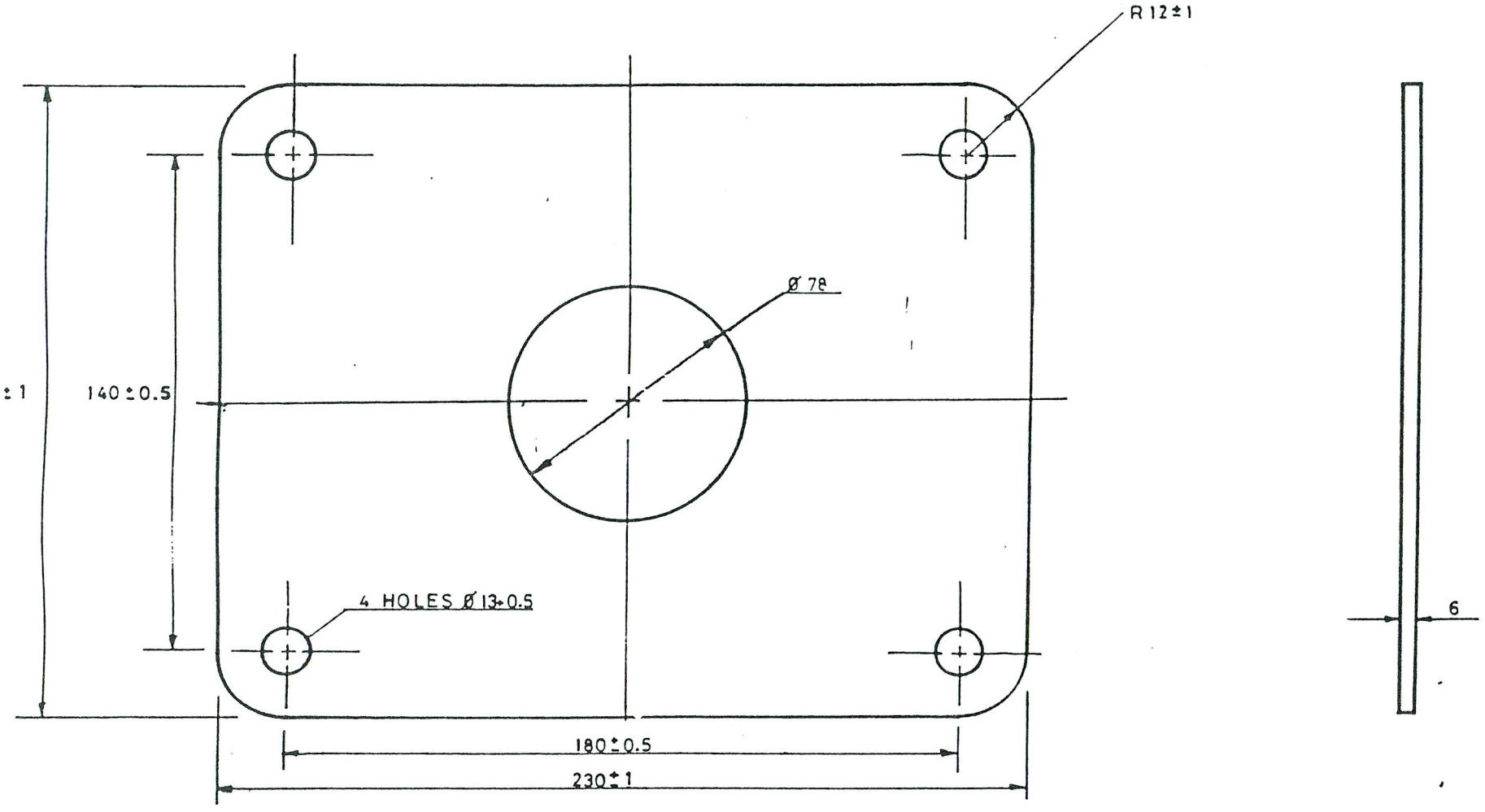
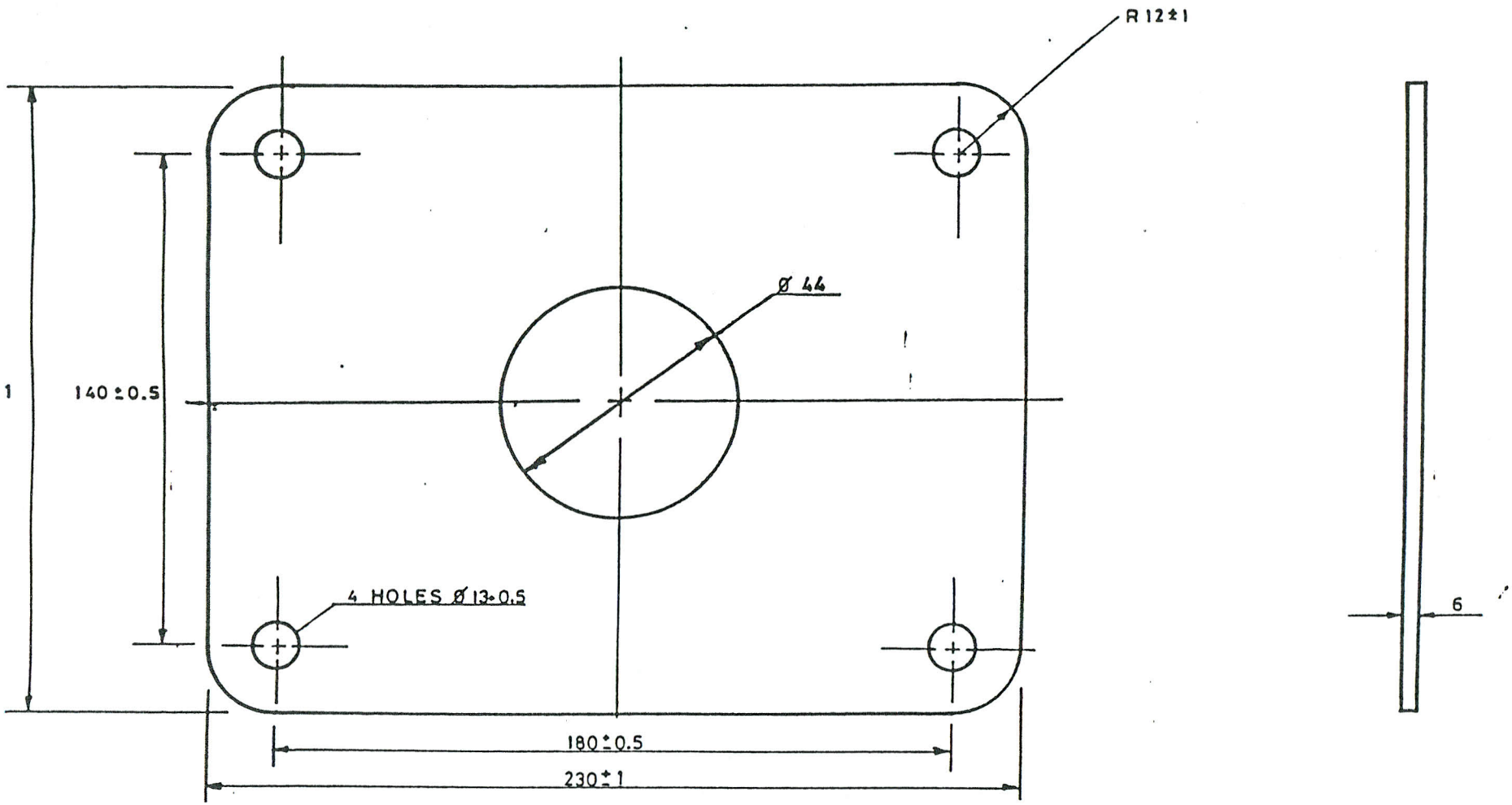






FIGURE NO: 6b

WATER TANK BOTTOM FLANGE




IGURE NO: 6c

WATER TANK BOTTOM FLANGE

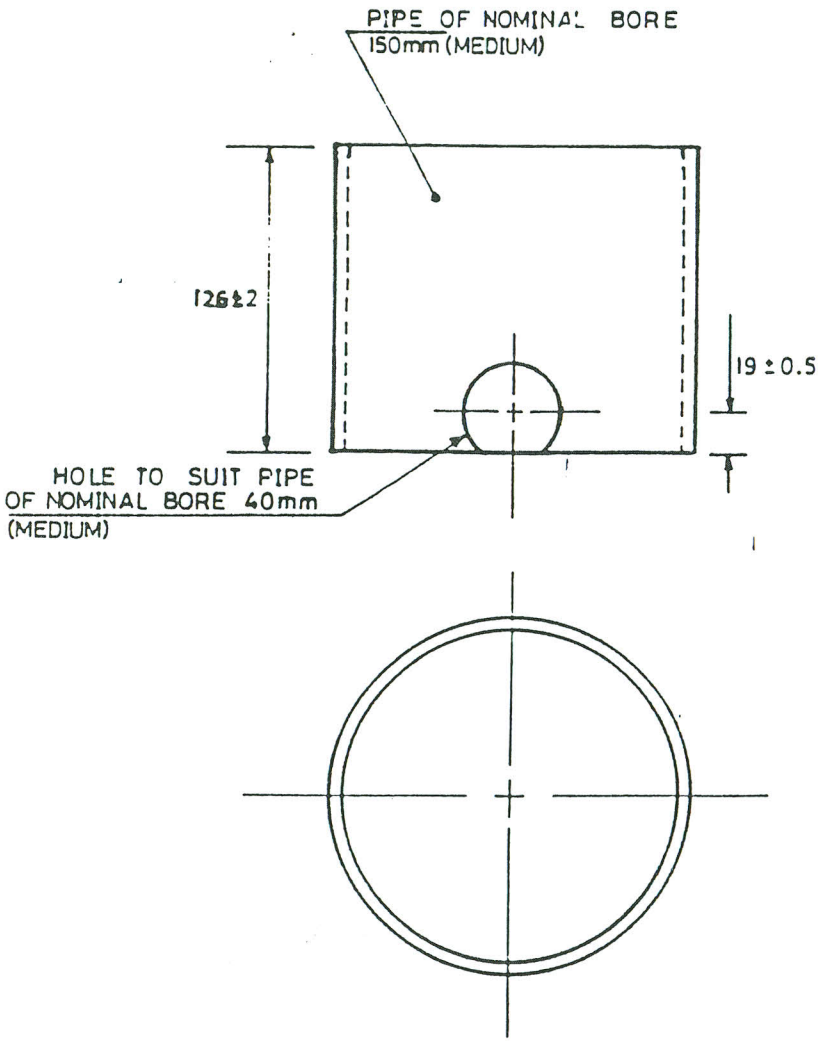
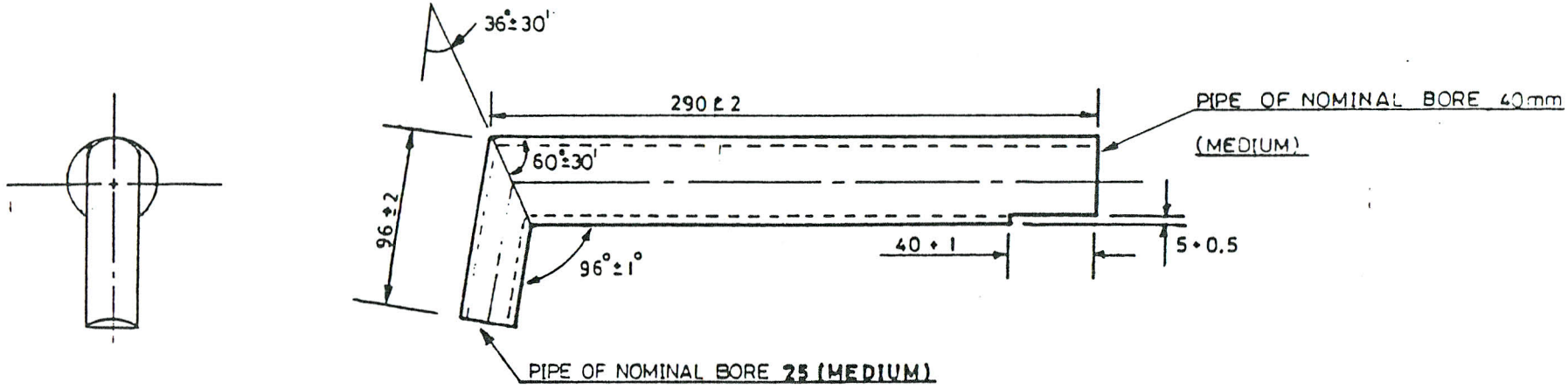



FIGURE NO: 6d

TANK PIPE




GURE NO: 6e

SPOUT PIPE

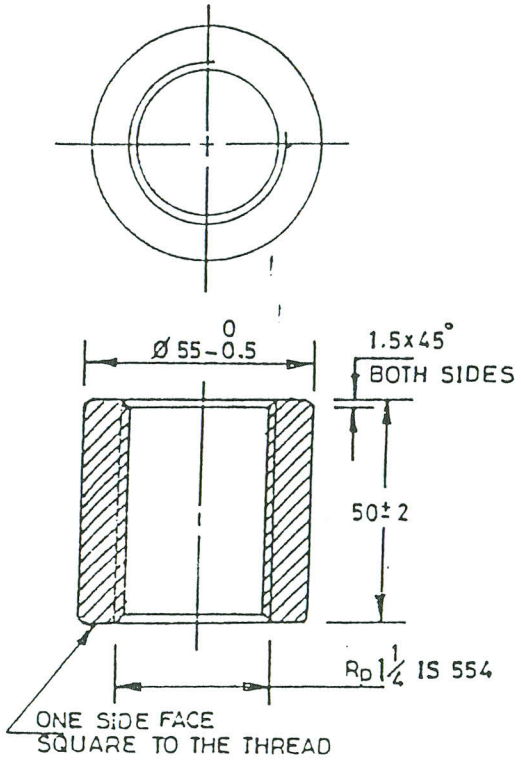
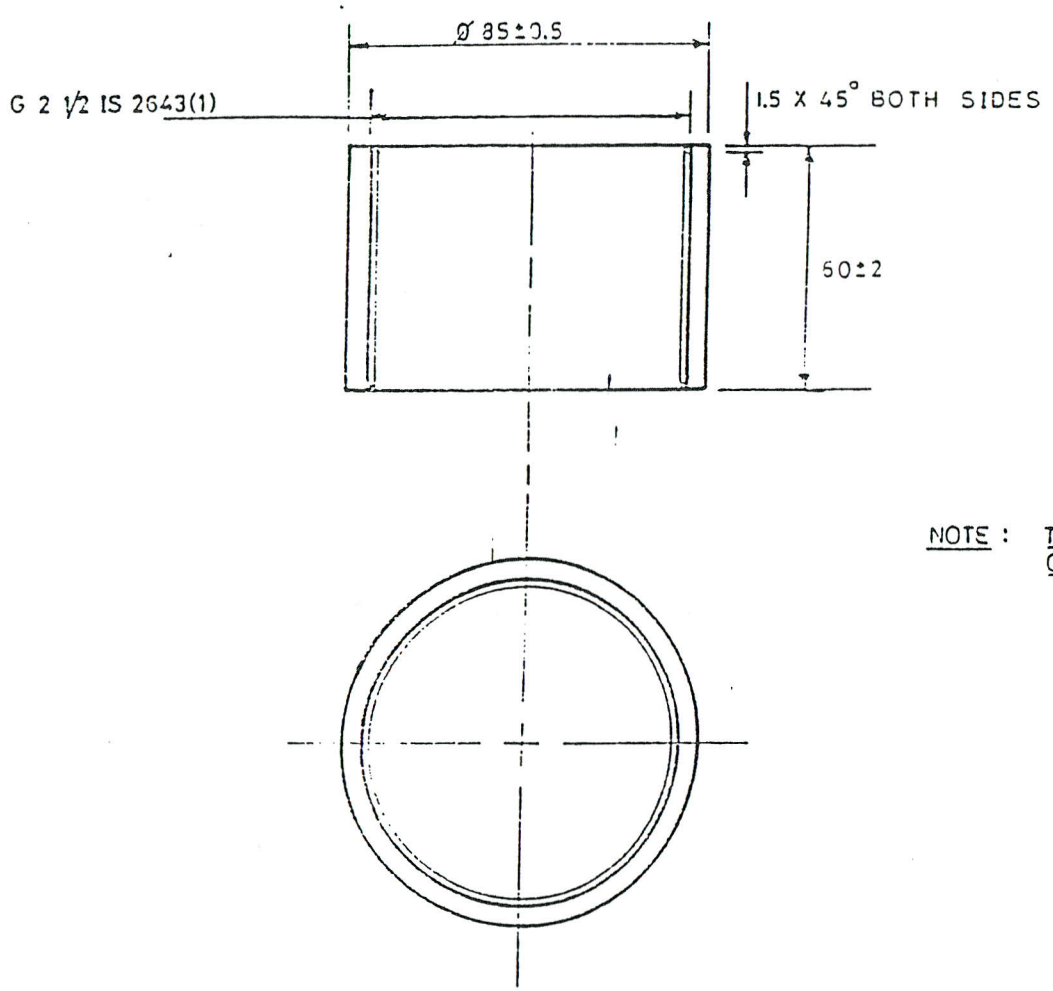



FIGURE NO : 6f

RISER PIPE HOLDER




NOTE : TO BE MANUFACTURED FROM ROD OR SEAMLESS PIPE

FIGURE NO; 6g

RISER PIPE HOLDER

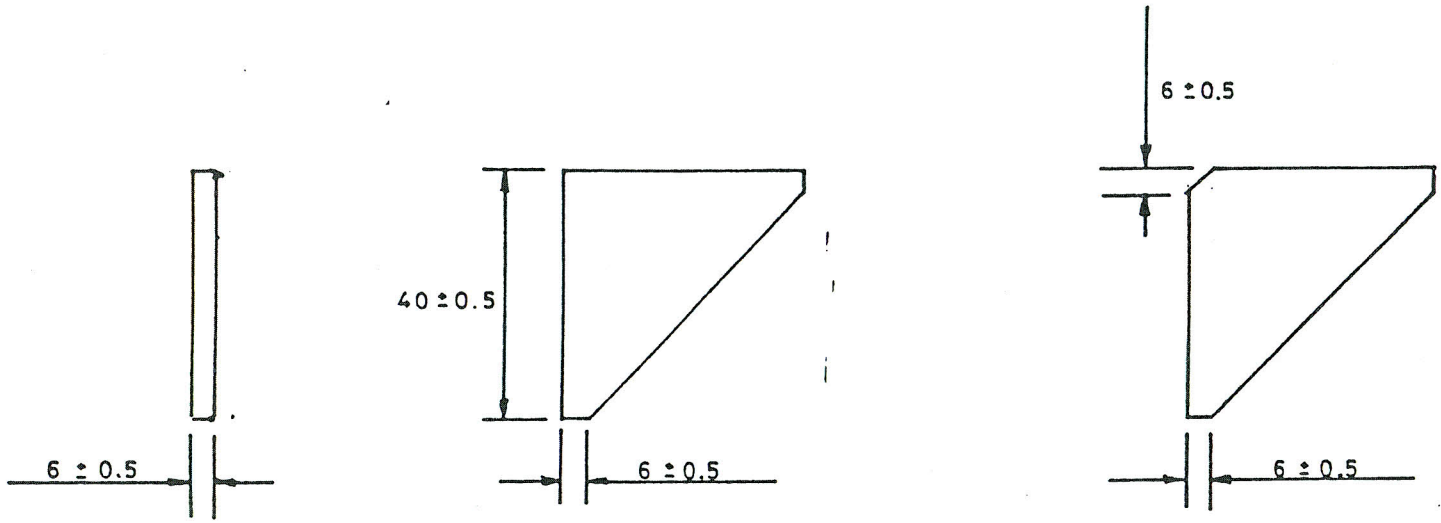
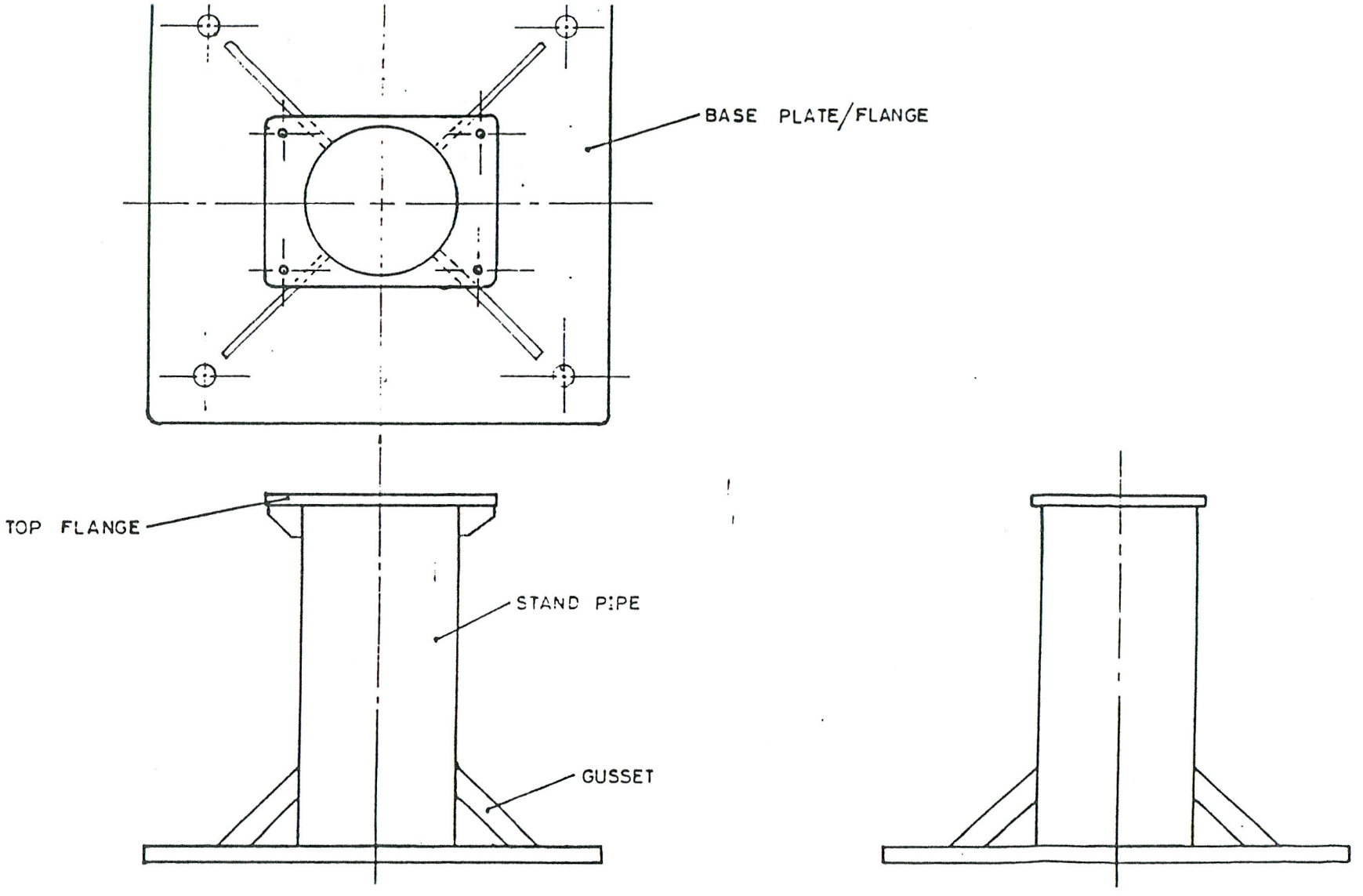



FIGURE NO : 6h

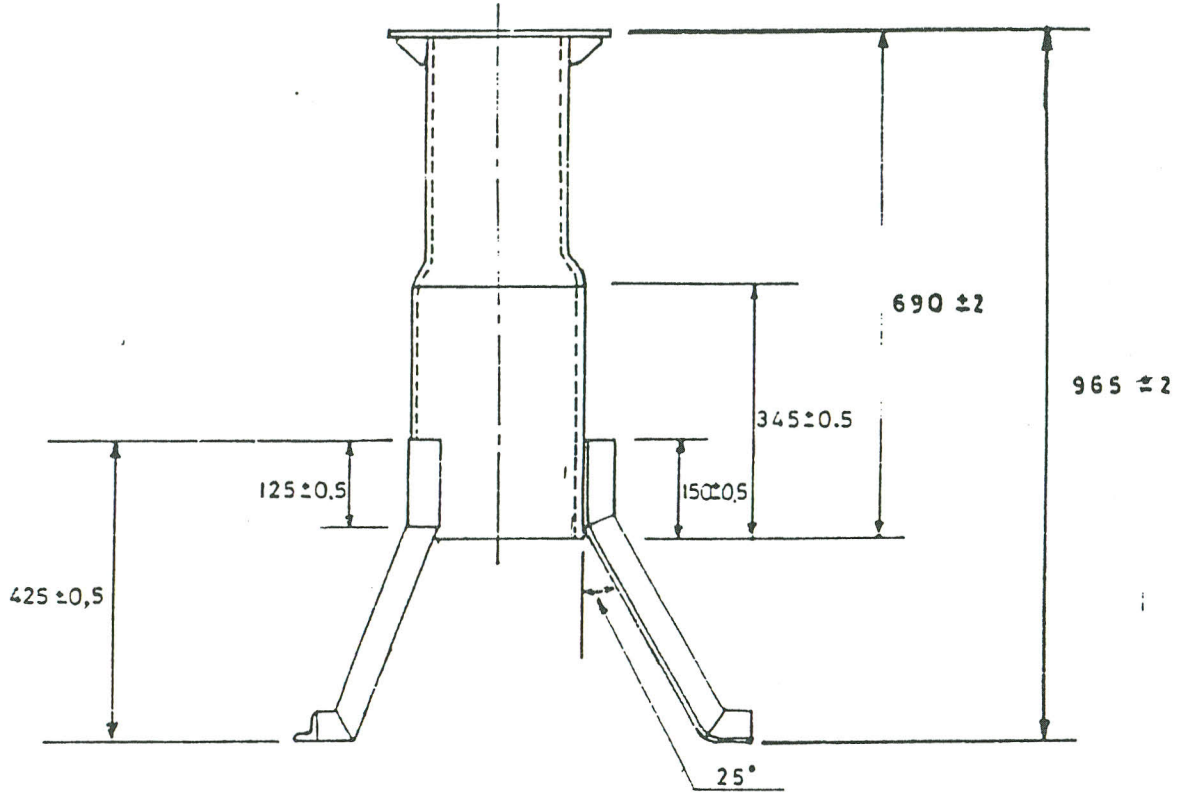
WATER TANK GUSSET

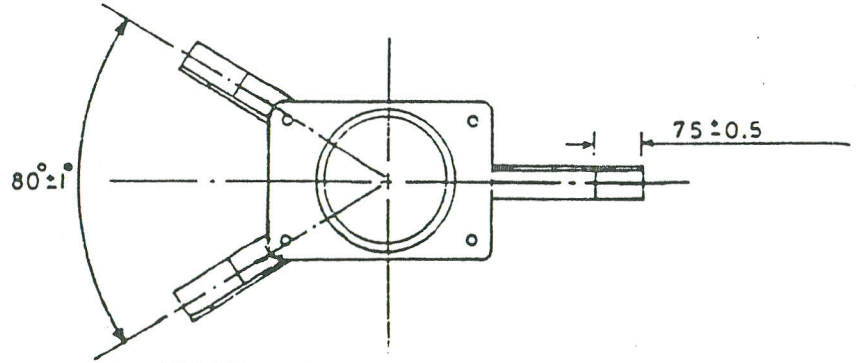



BASE PLATE OPTION

FIGURE NO : 7

STAND

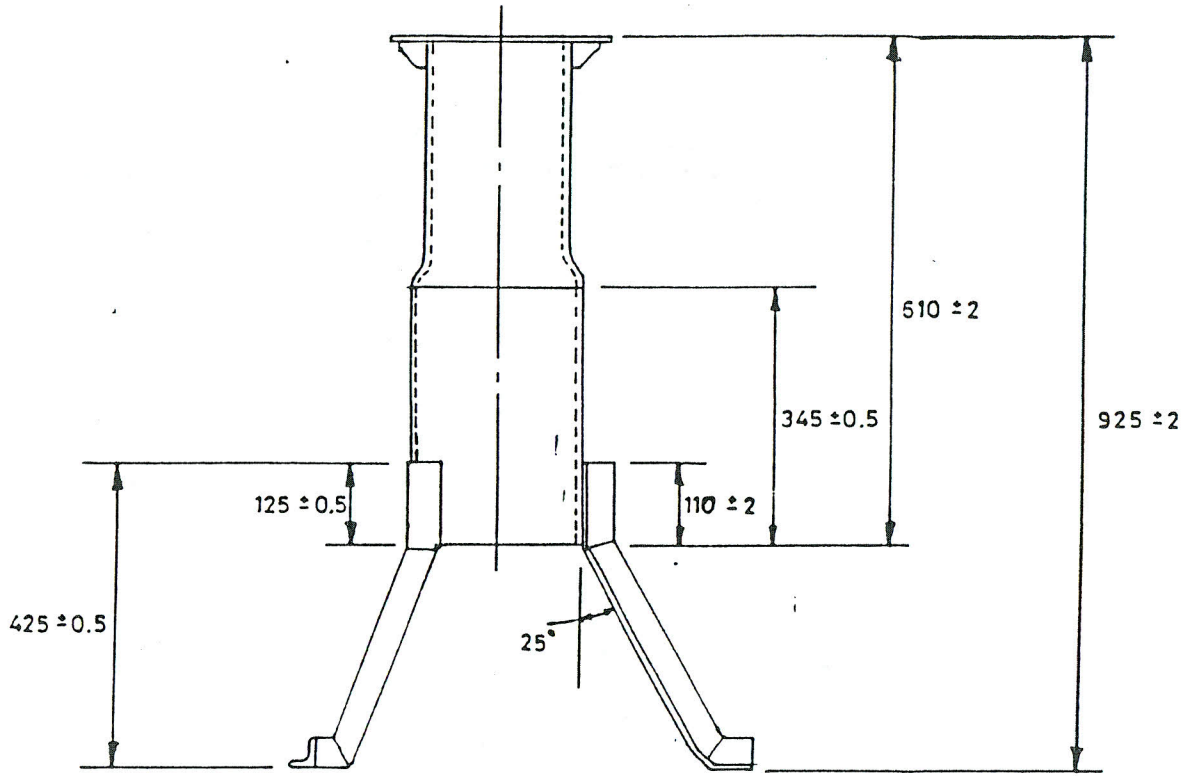



150 & 175 NB PIPE OPTION 1

FIGURE NO: 7a

STAND ASSEMBLY



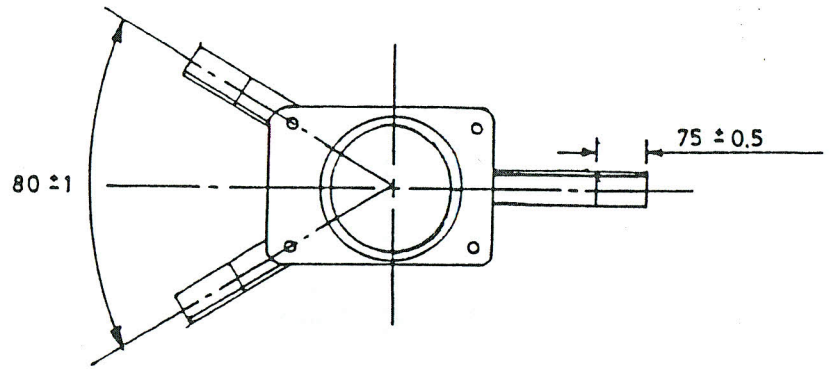
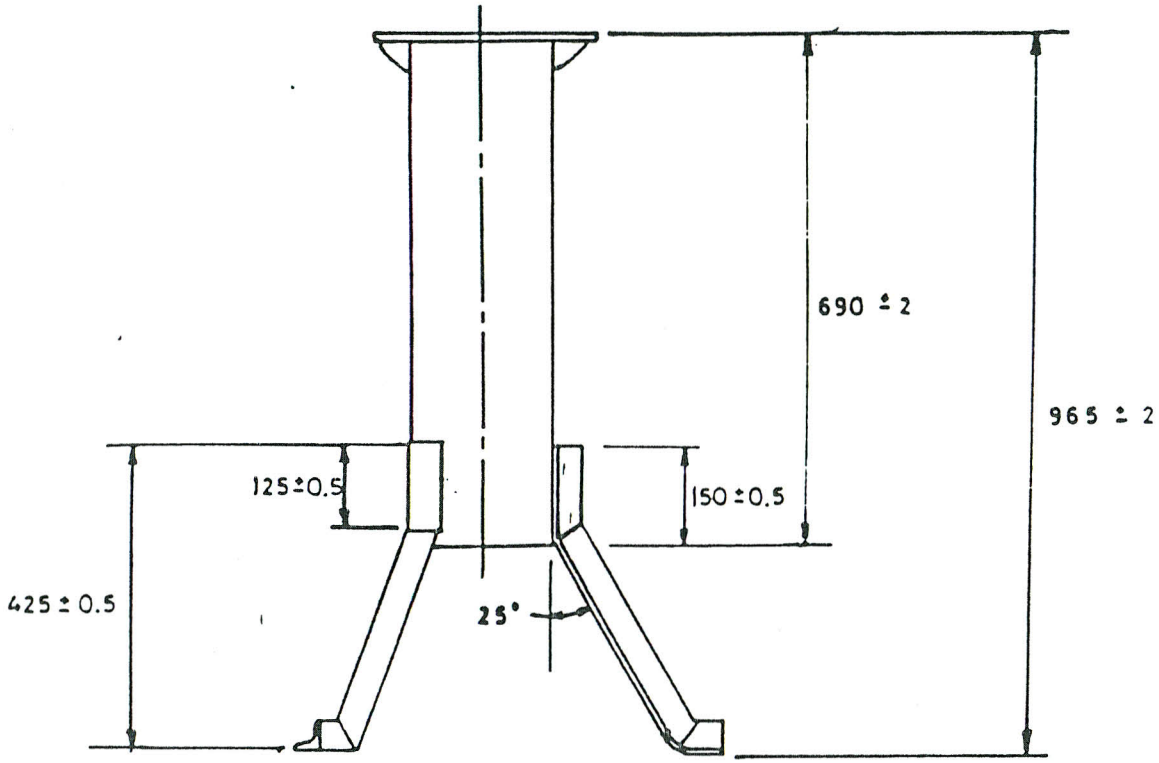
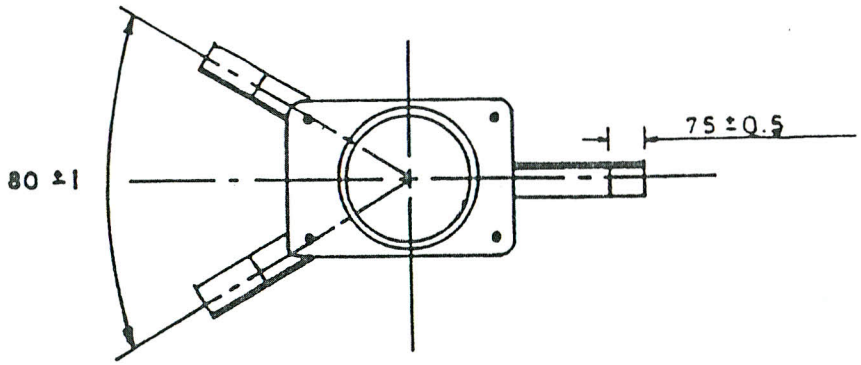




FIGURE NO : 7b

150 & 175 NB PIPE OPTION 2

STAND ASSEMBLY




150 NB PIPE OPTION 1

FIGURE NO : 7c

STAND ASSEMBLY

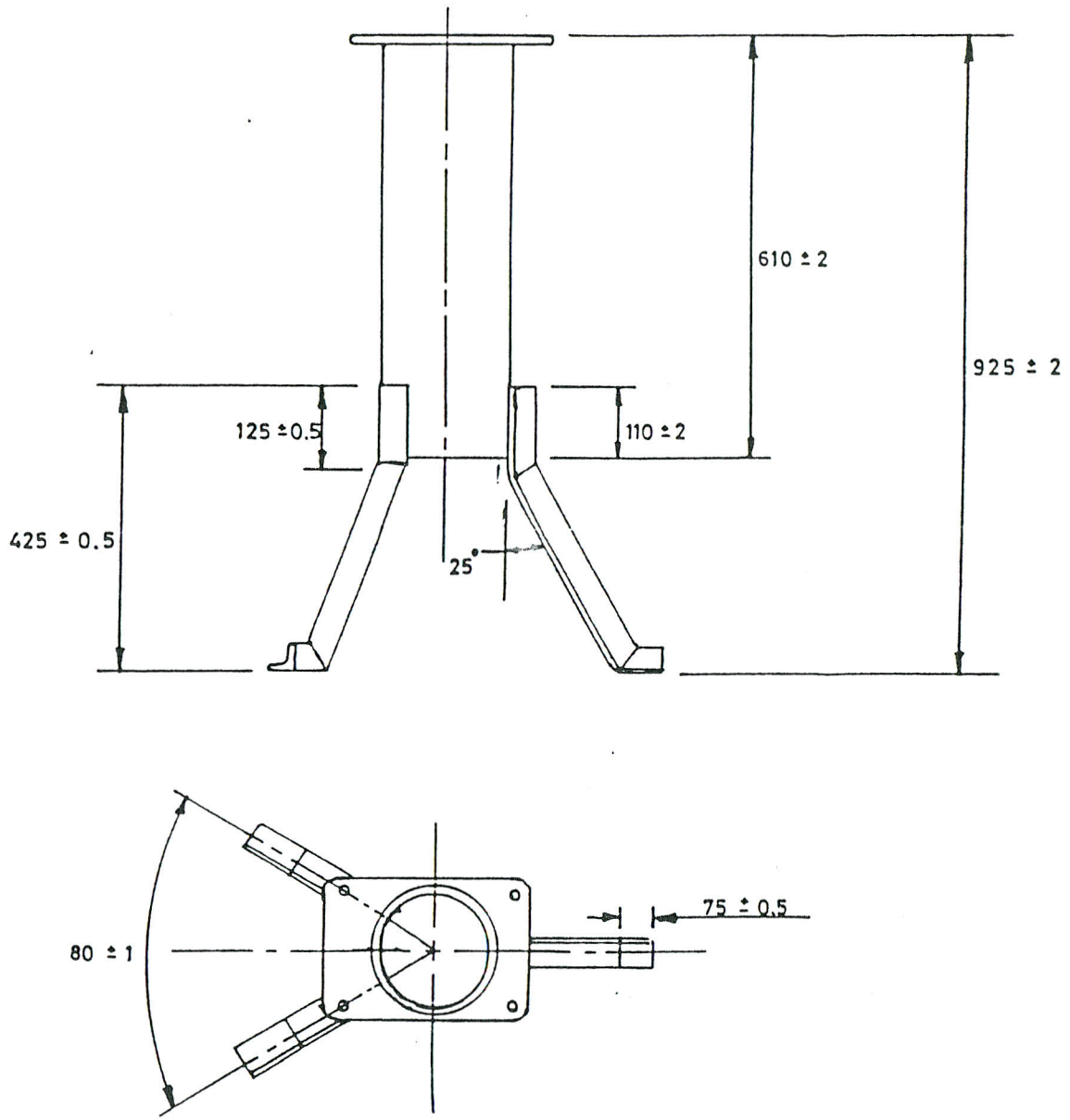



FIGURE NO: 7d

150 NB PIPE OPTION 2

STAND ASSEMBLY

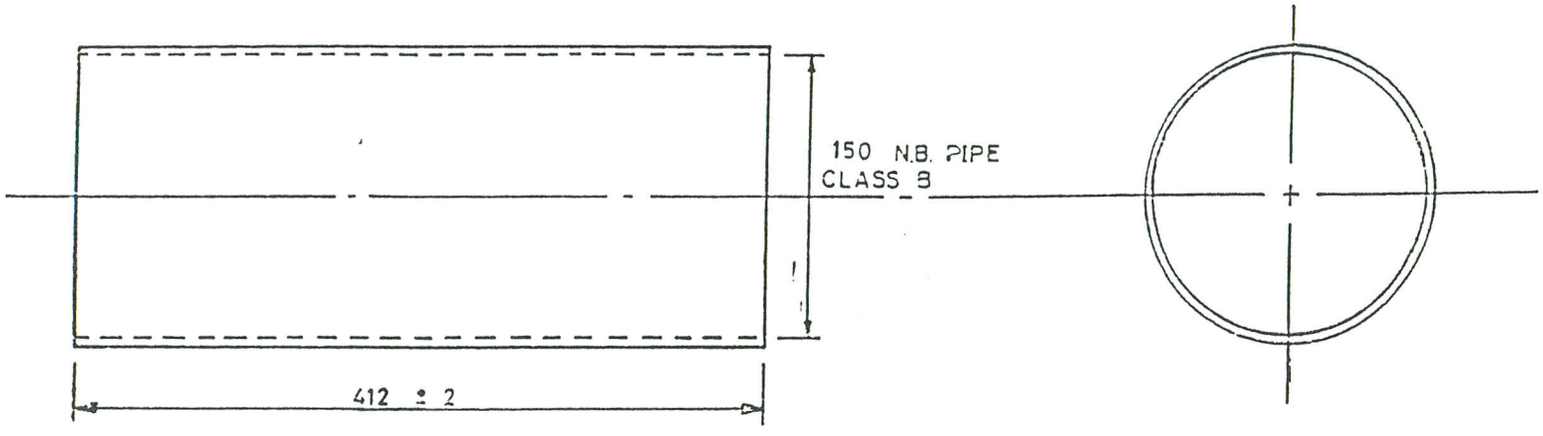
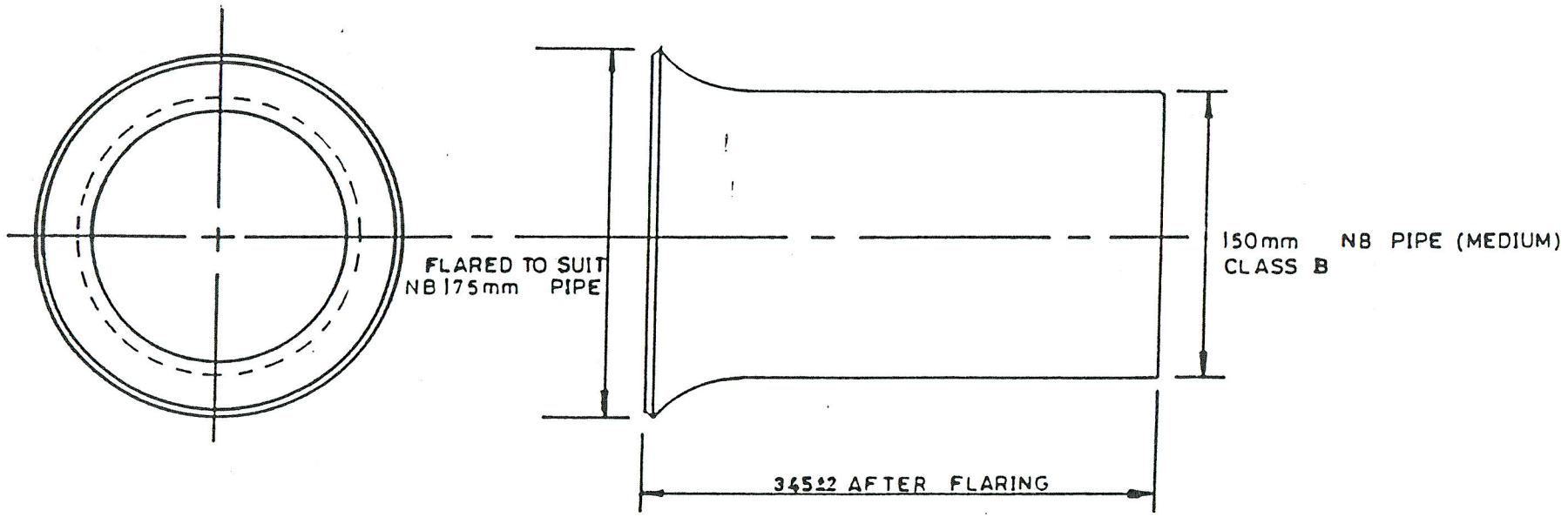



FIGURE NO : 7e

BASE PLATE OPTION

STAND PIPE

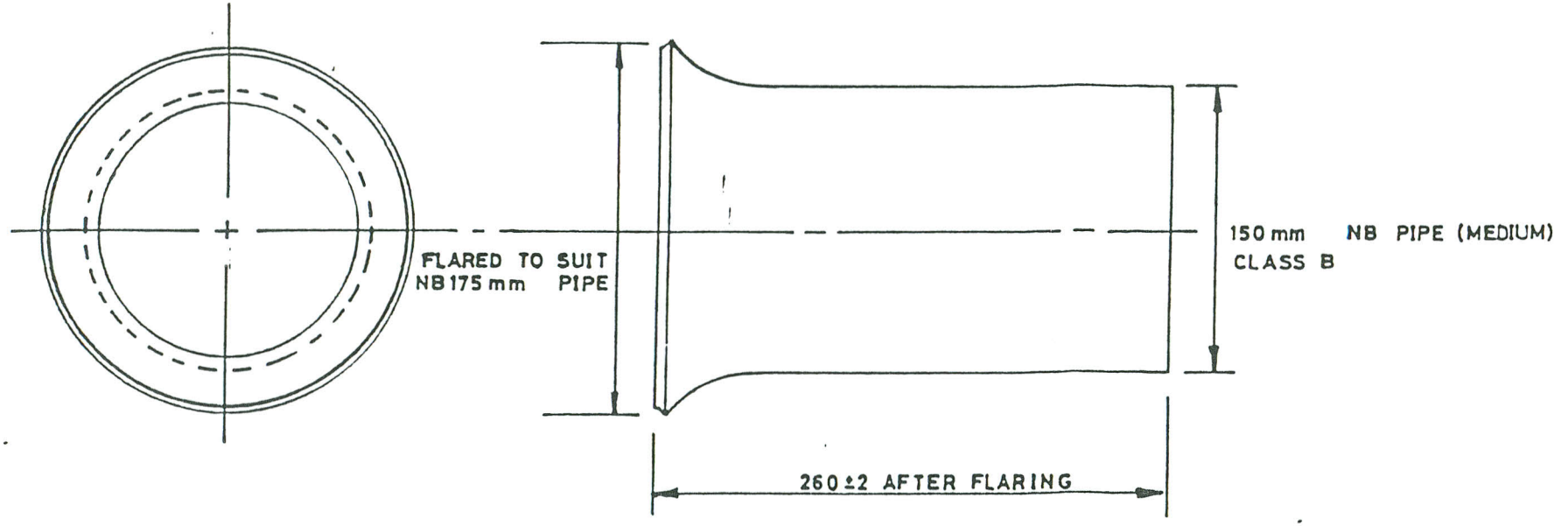



FLARING OPTION

FIGURE NO : 7f

150&175 NB PIPE OPTION 1

150 NB PIPE




FLARING OPTION

FIGURE NO : 7g

150 & 175 NB PIPE OPTION 2

150 NB PIPE

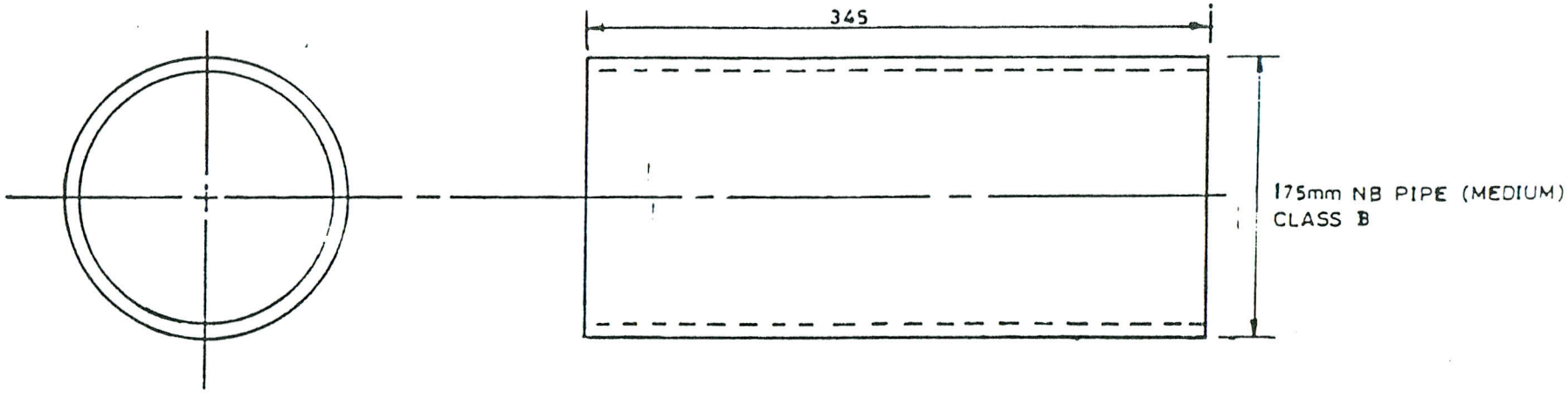



FIGURE NO : 7h

150&175 NB PIPE OPTION 1 & 2

175 NB PIPE

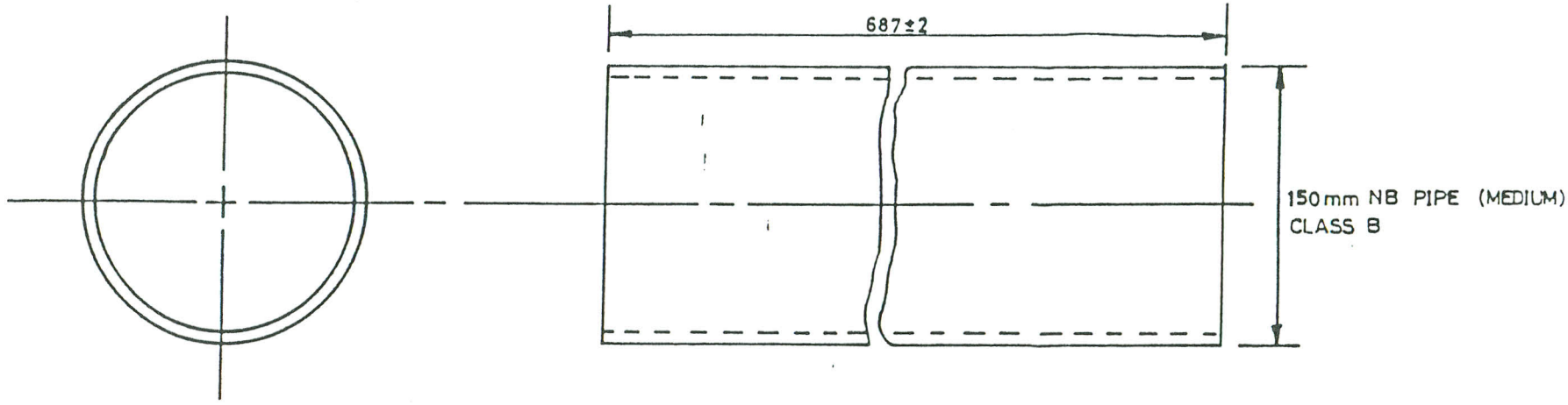



FIGURE NO : 7i

150 NB PIPE OPTION 1

STAND PIPE

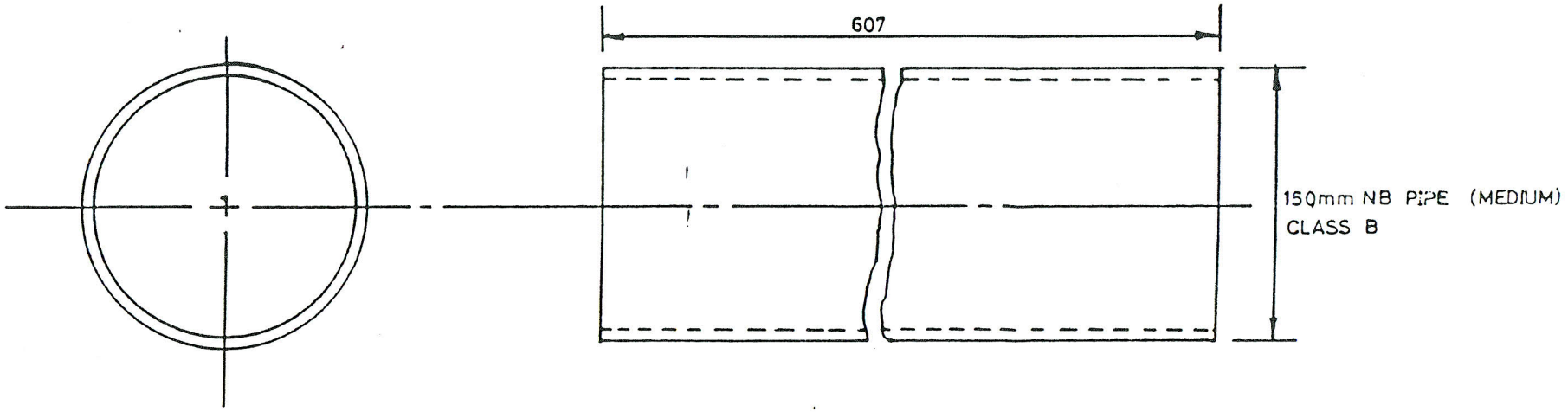
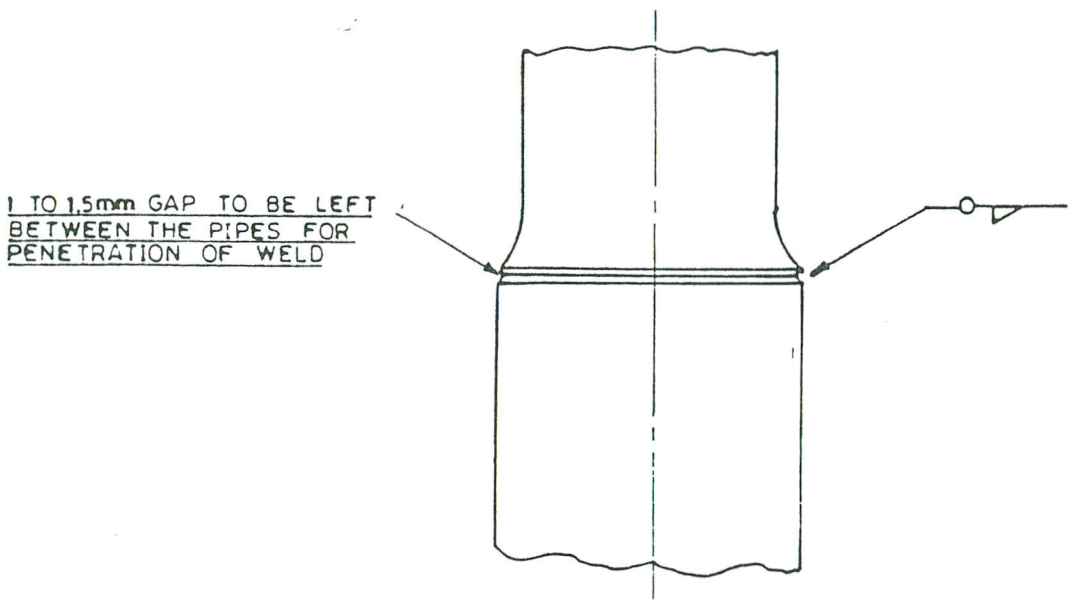



FIGURE NO : 7j

150 NB PIPE OPTION 2

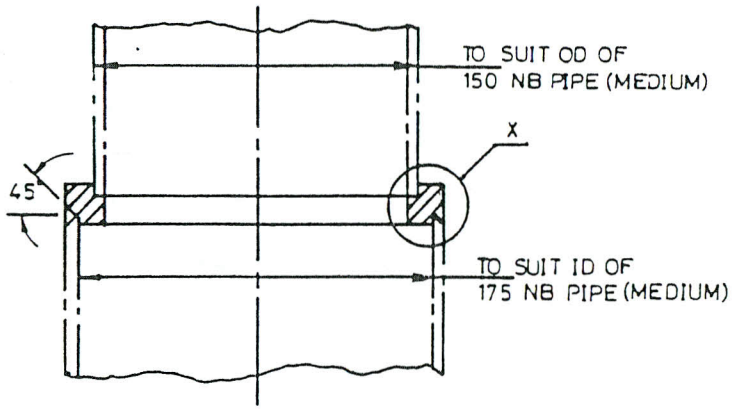
STAND PIPE

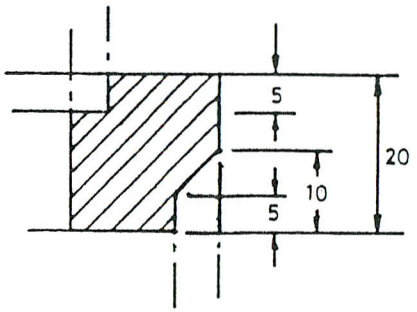



FLARING OPTION

FIGURE NO : 7k

WELDING OF DEEP WELL STAND




ENLARGED DETAIL X

REDUCER COLLAR OPTION

FIGURE NO : 71

WELDING 150 NB PIPE TO 175 NB PIPE

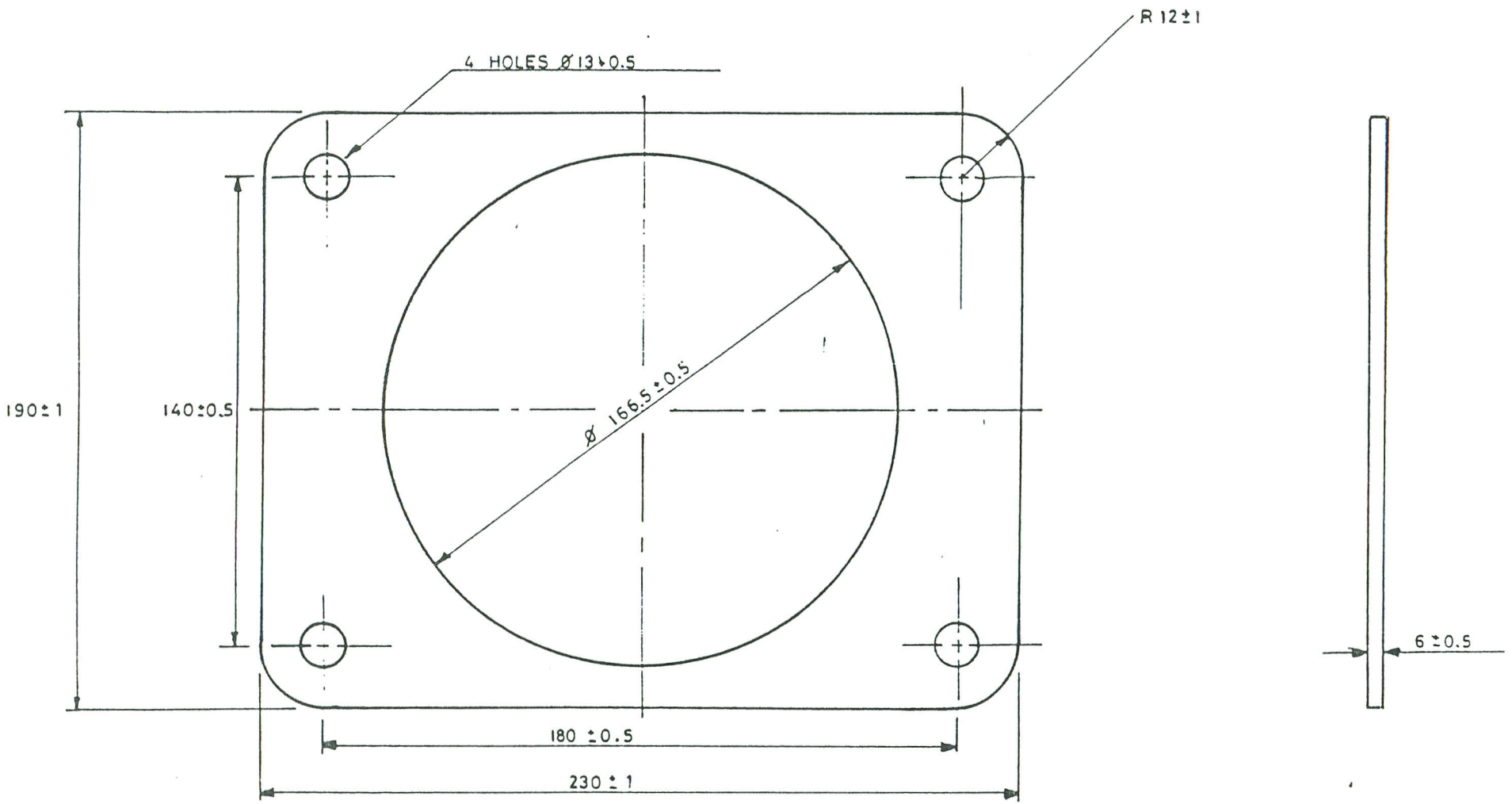
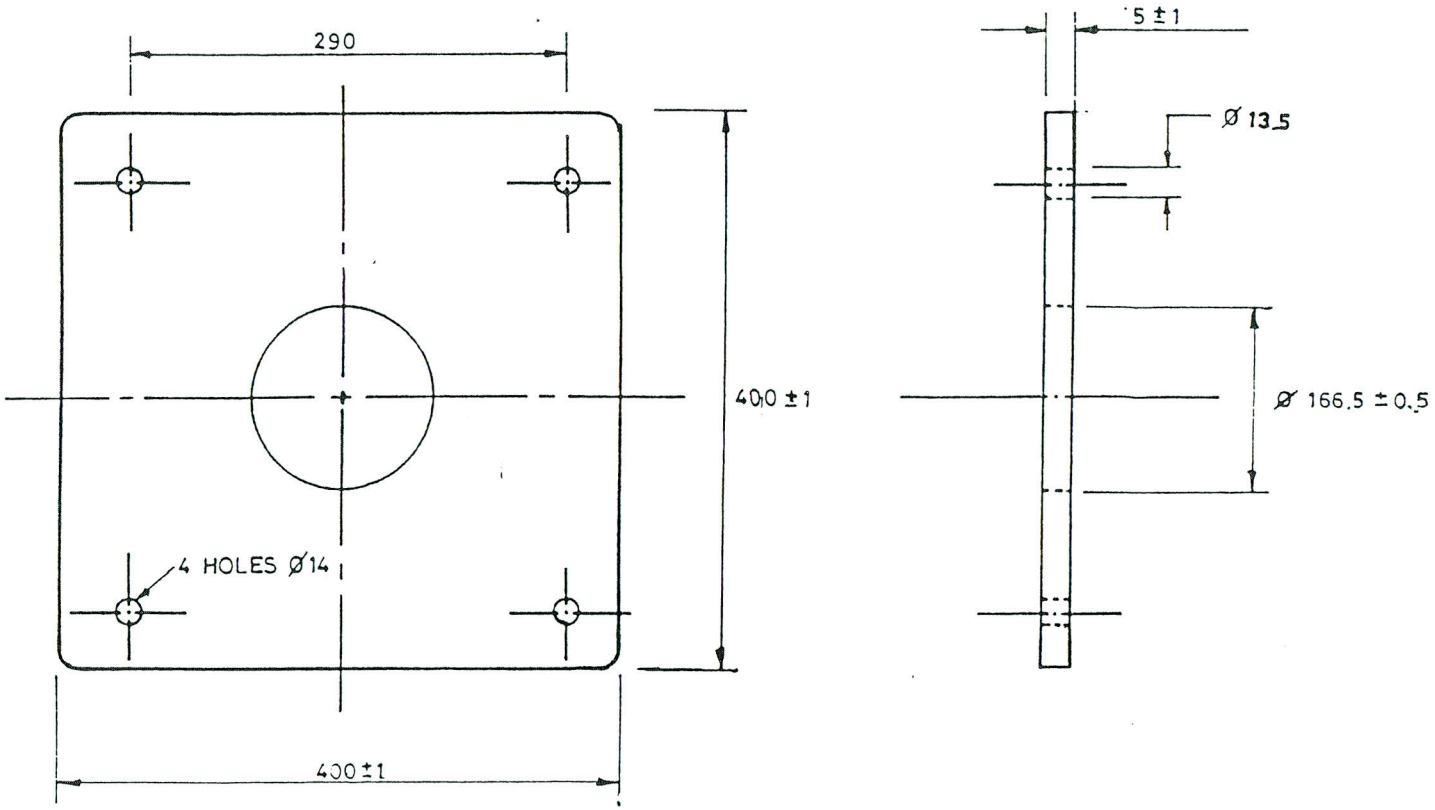


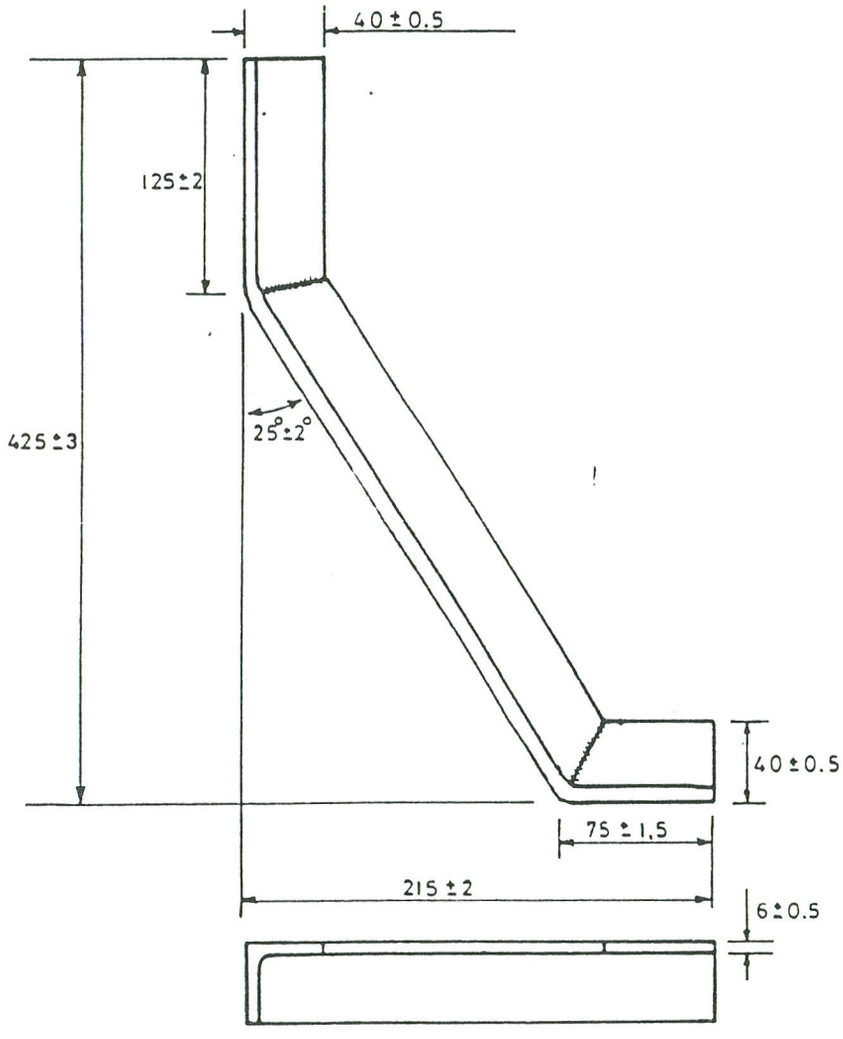

FIGURE NO: 7m

STAND ASSEMBLY FLANGE (TOP)




FLANGE NO : 7n

BASE PLATE/FLANGE



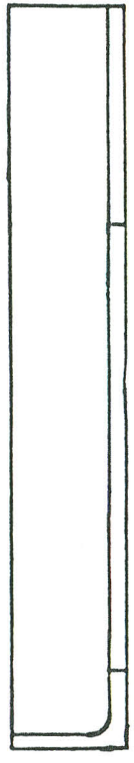



FIGURE NO; 7p

LEGS (STAND)

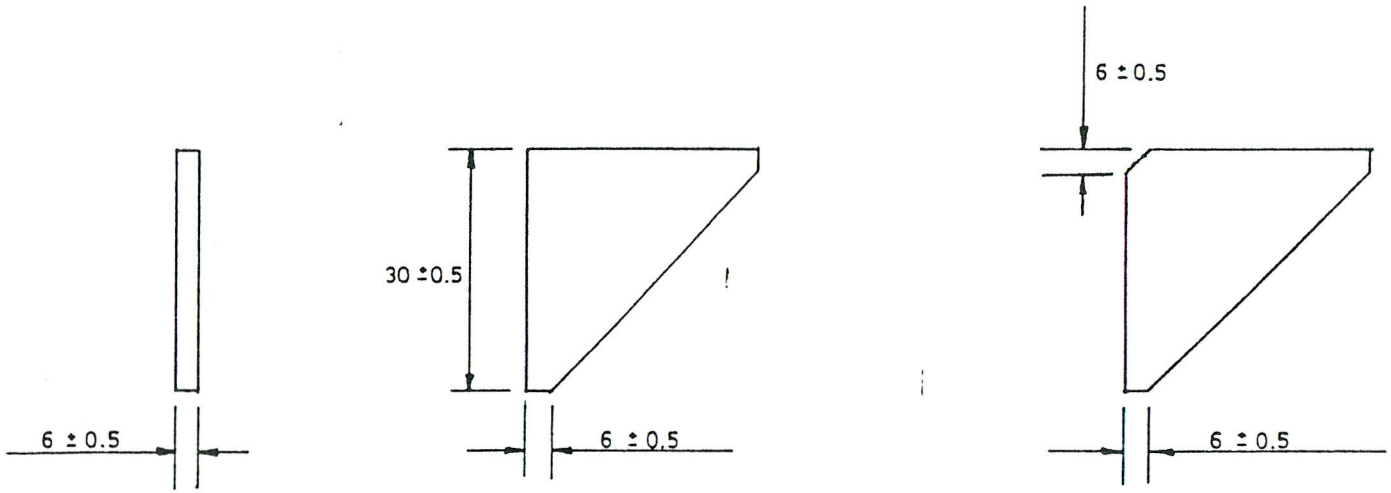



FIGURE NO : 7q

STAND ASSEMBLY GUSSET

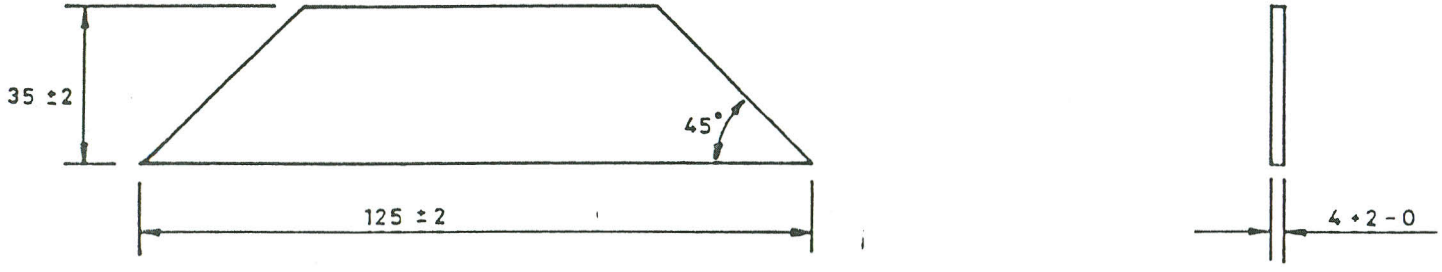



FIGURE NO : 7r

BOTTOM FLANGE GUSSET

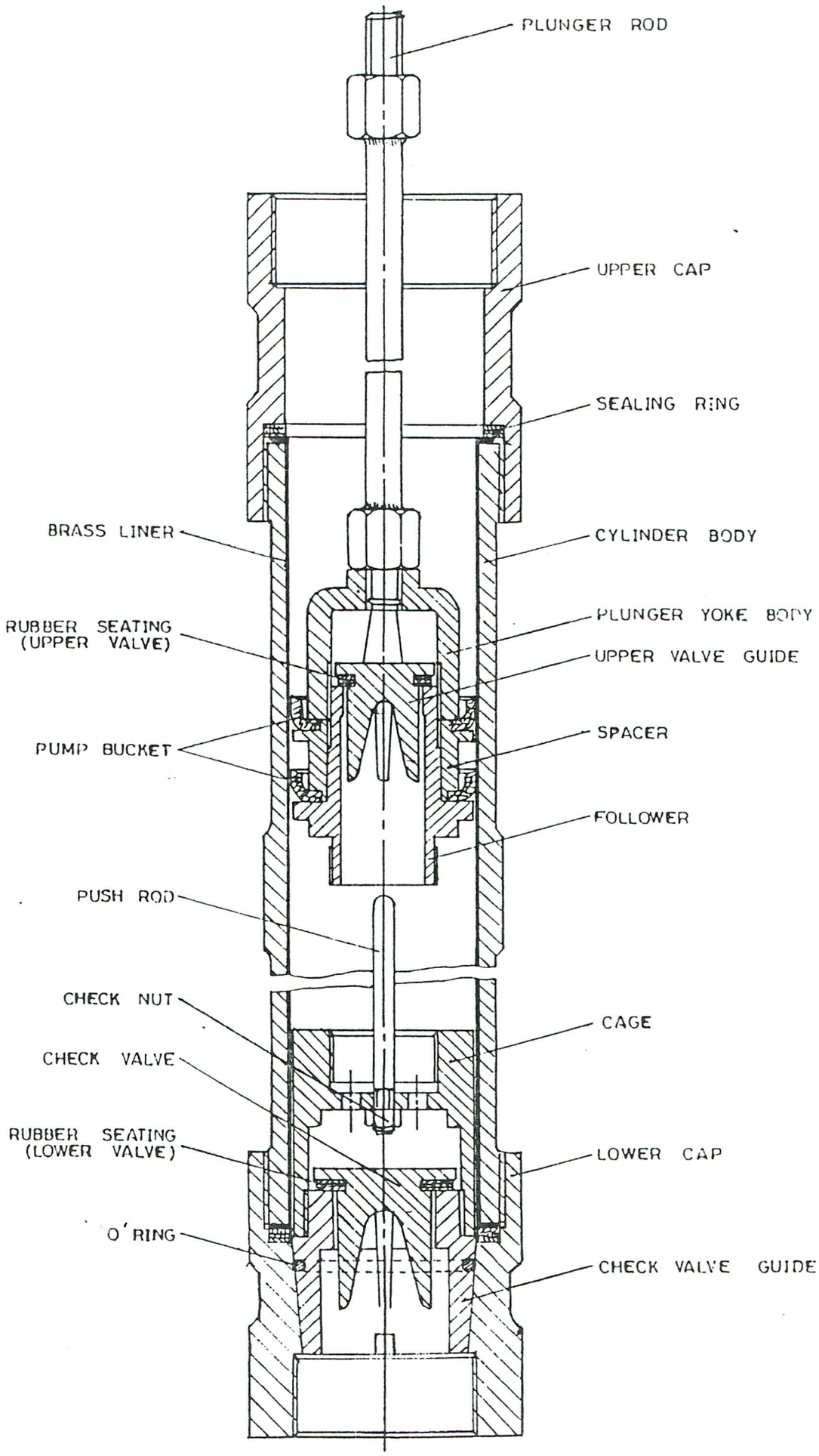
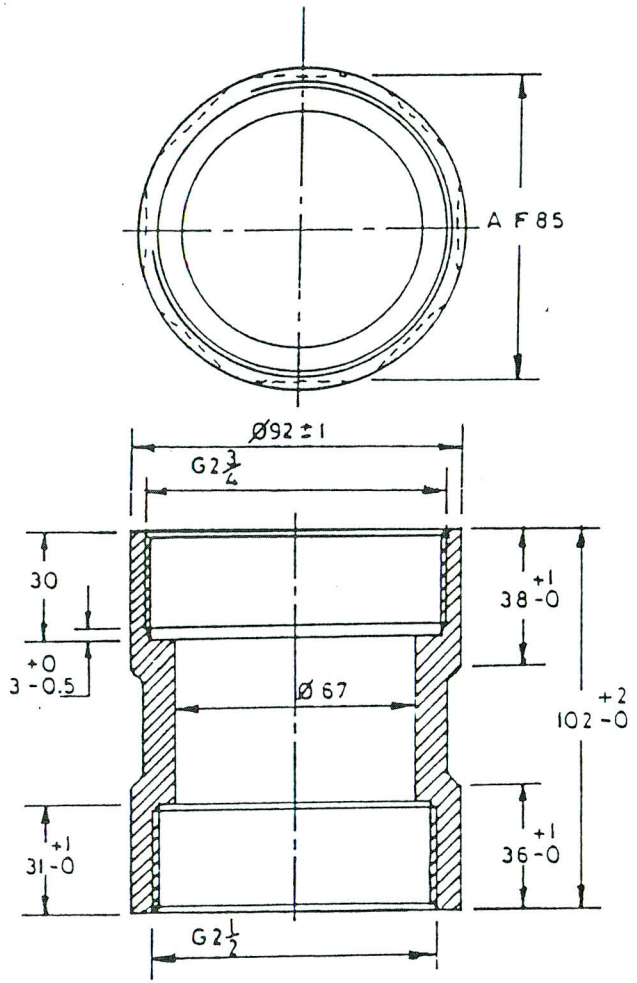
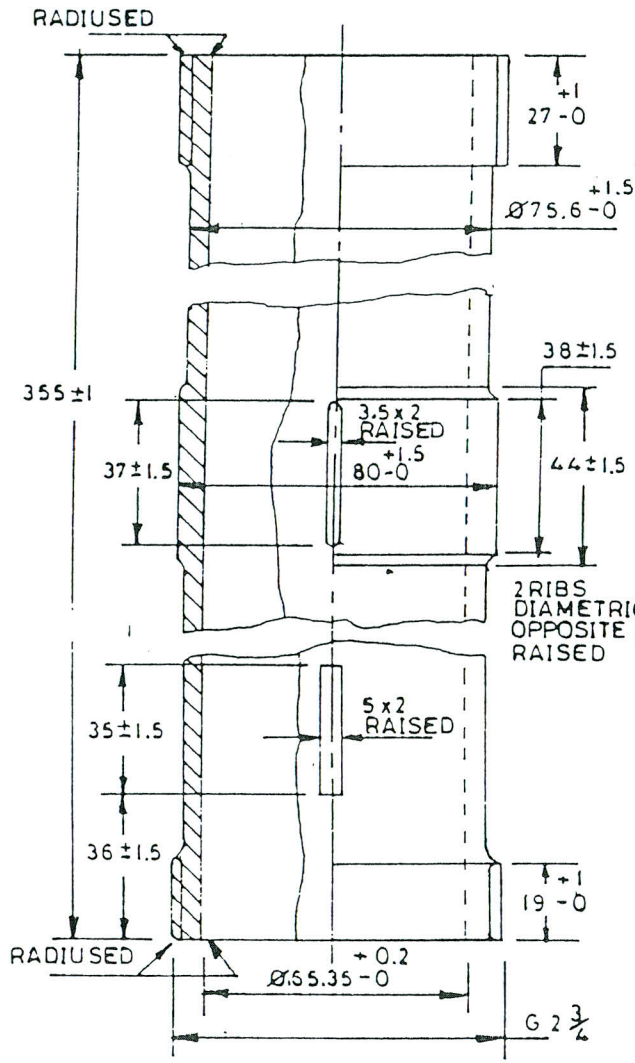



FIGURE NO : 8 CYLINDER ASSEMBLY



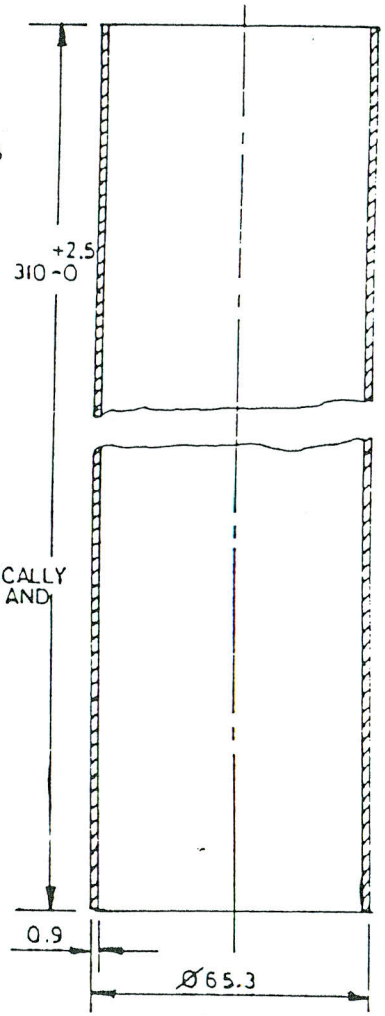

UPPER CAP

FIGURE 8a




CYLINDER BODY

FIGURE 8b

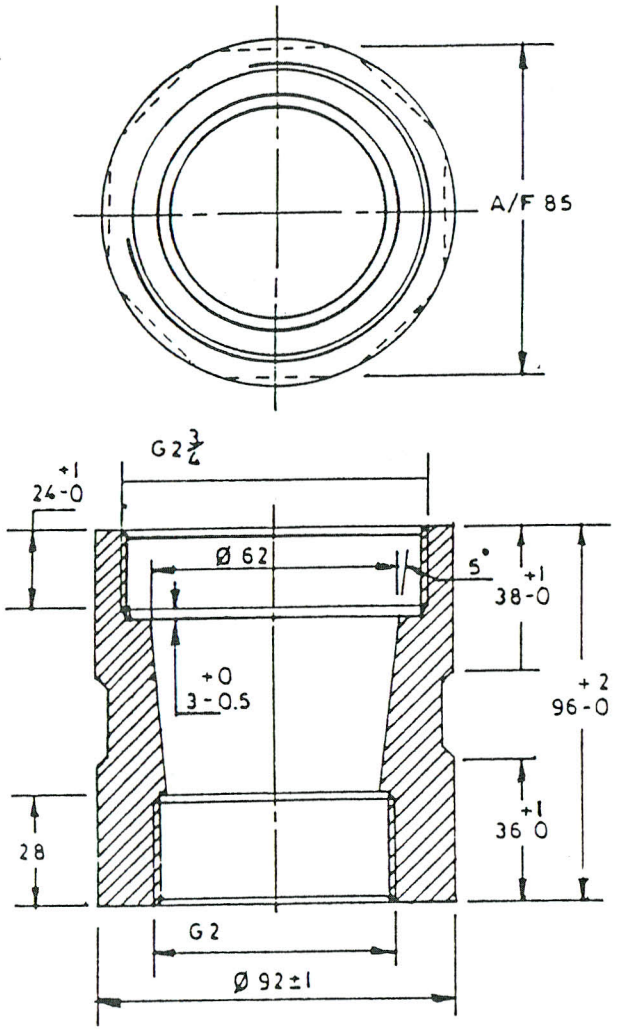



BRASS LINER

FIGURE 8c

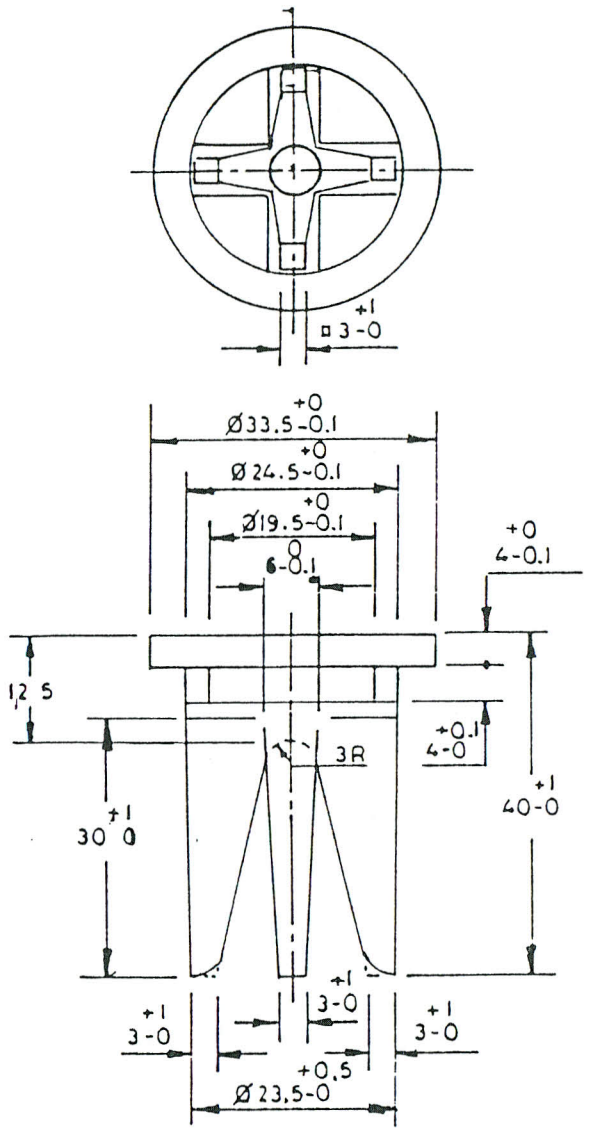
FIGURE NO : 8a 8b & 8c

CYLINDER ASSEMBLY PARTS




BOTTOM CAP

FIGURE 8d

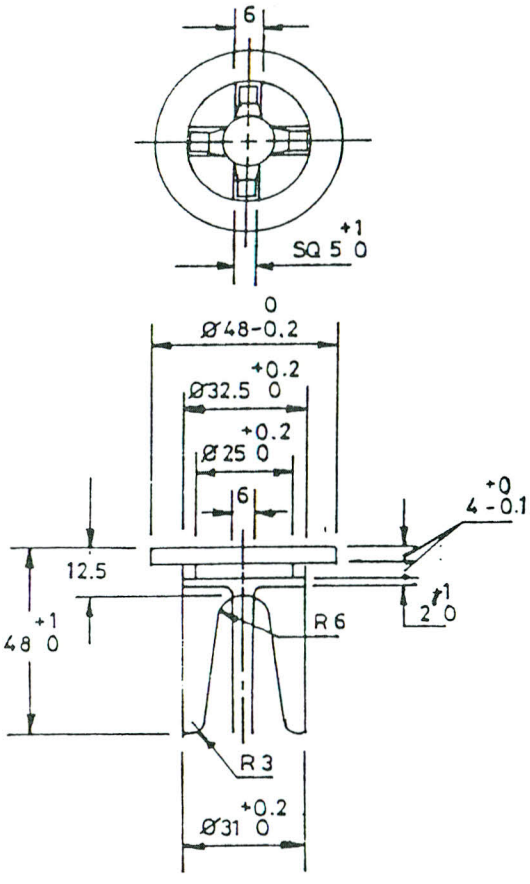



UPPER VALVE

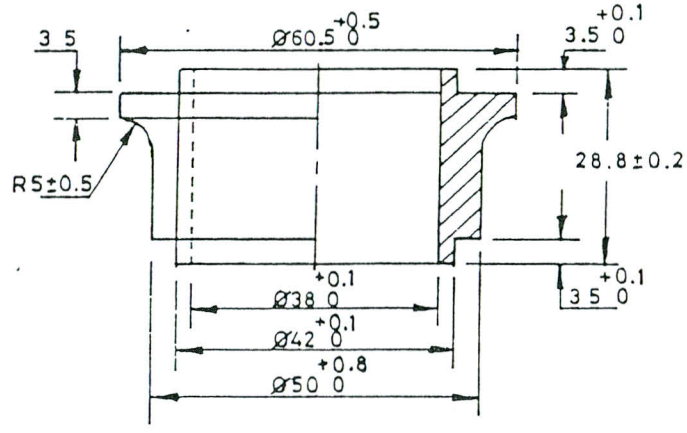
FIGURE 8e

FIGURE NO : 8d & 8e

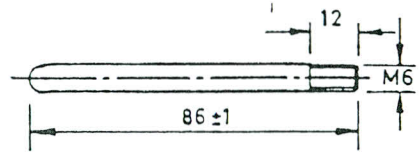
CYLINDER ASSEMBLY PARTS




CHECK VALVE
FIGURE 8f




SPACER
FIGURE 8g




PUSH ROD
FIGURE 8h

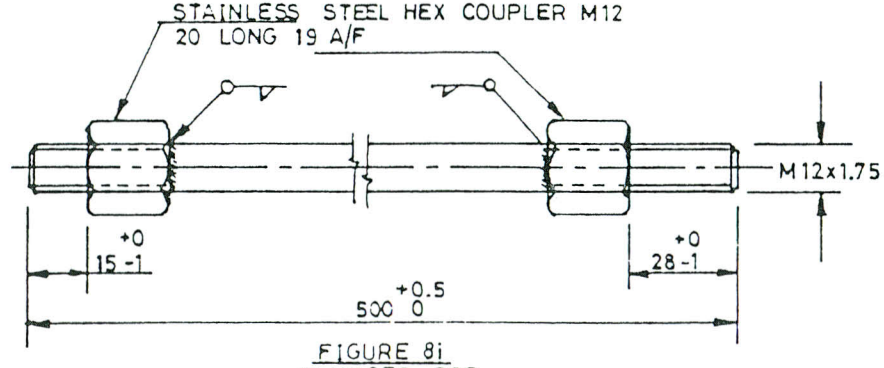
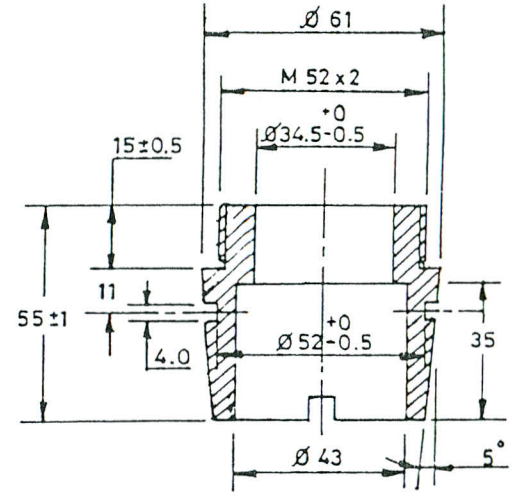
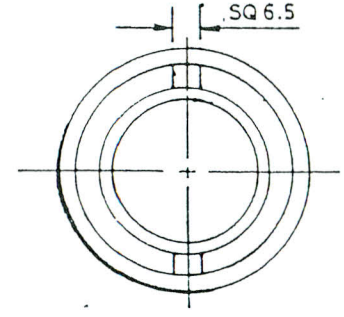



FIGURE 8i
PLUNGER ROD

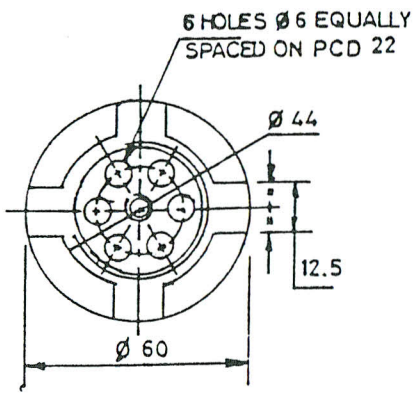


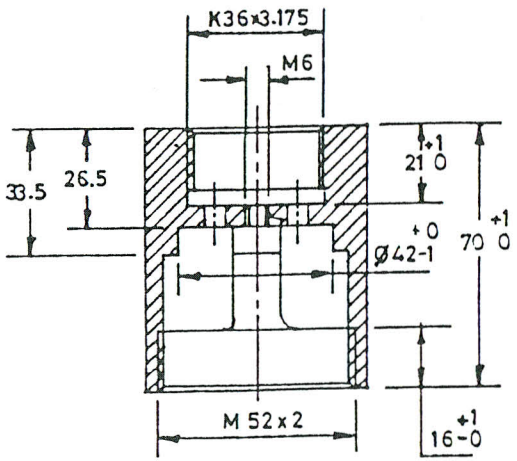




CHECK VALVE
SEAT
FIGURE 8j

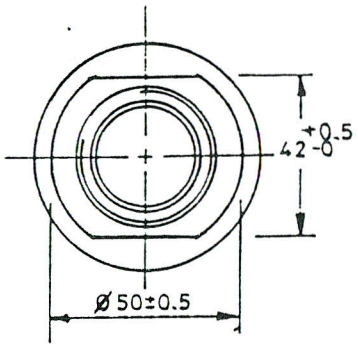
FIGURE NO : 8f,8g,8h,8i & 8j

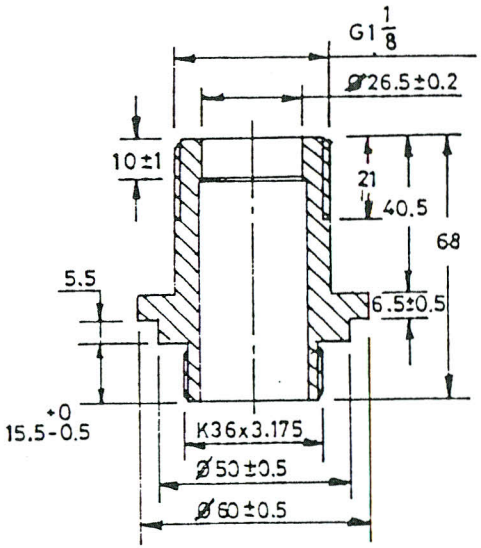
CYLINDER ASSEMBLY PARTS



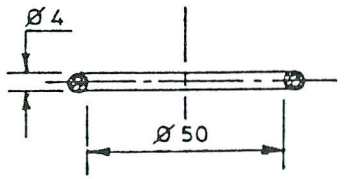




CAGE
FIGURE 8k

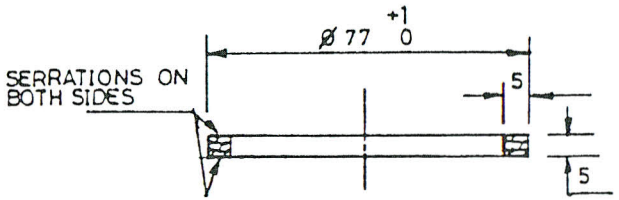


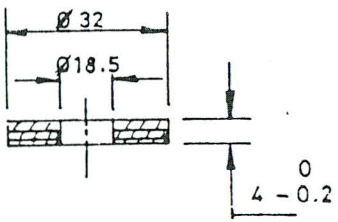

FOLLOWER
FIGURE 8l



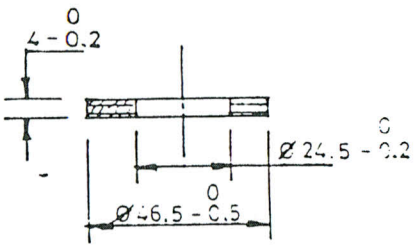

'O' RING NITRILE RUBBER
FIGURE 8m




SEALING RING
FIGURE 8n



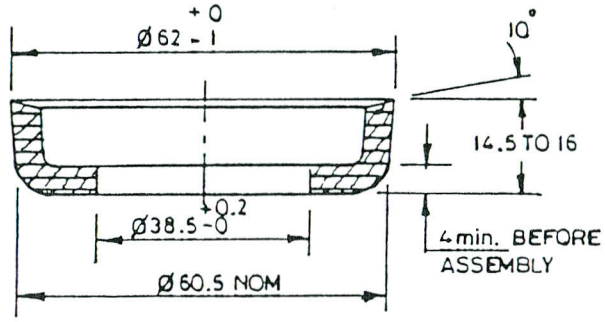

RUBBER SEATING
(UPPER VALVE)
FIGURE 8p



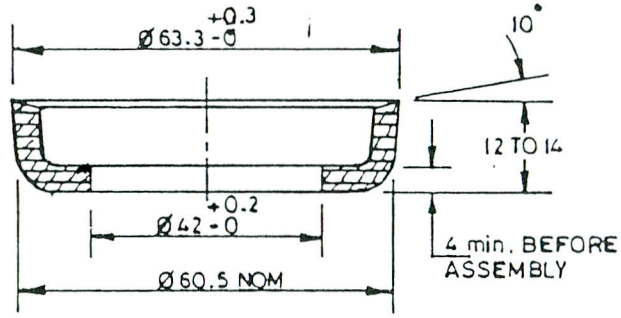

RUBBER SEATING
(UPPER VALVE)
FIGURE 8q

FIGURE NO : 8k,8l,8m,8n,8p & 8q

CYLINDER ASSEMBLY PARTS




LEATHER PUMP BUCKET
FIGURE 8r




NITRILE RUBBER PUMP BUCKET
FIGURE 8s

FIGURE NO : 8r & 8s

CYLINDER ASSEMBLY PARTS

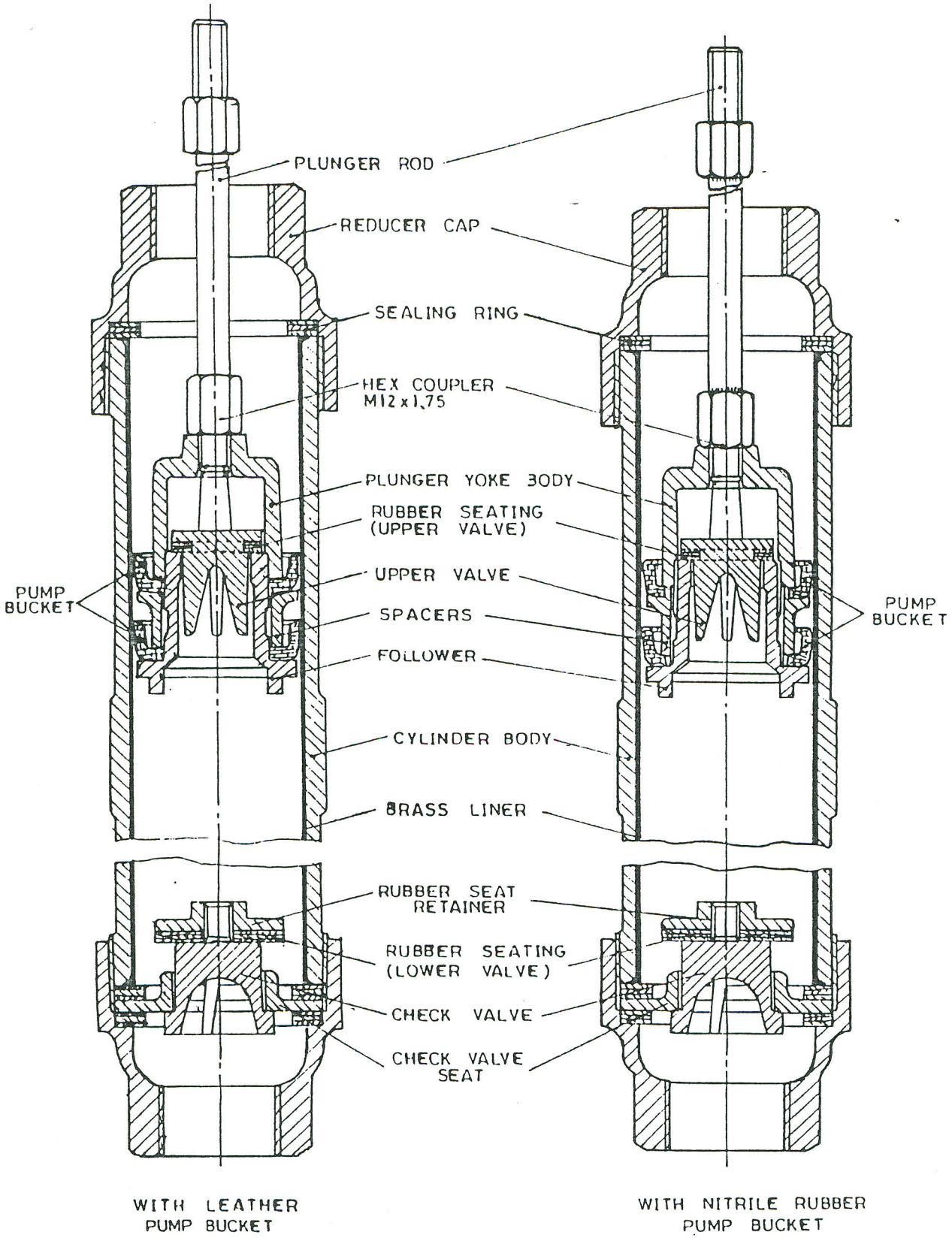
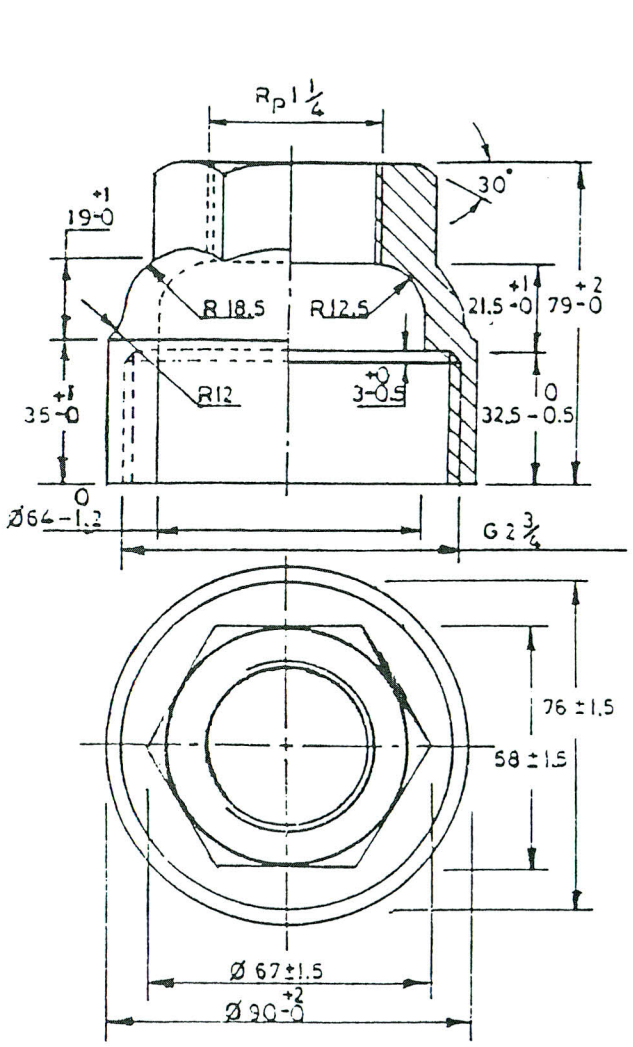
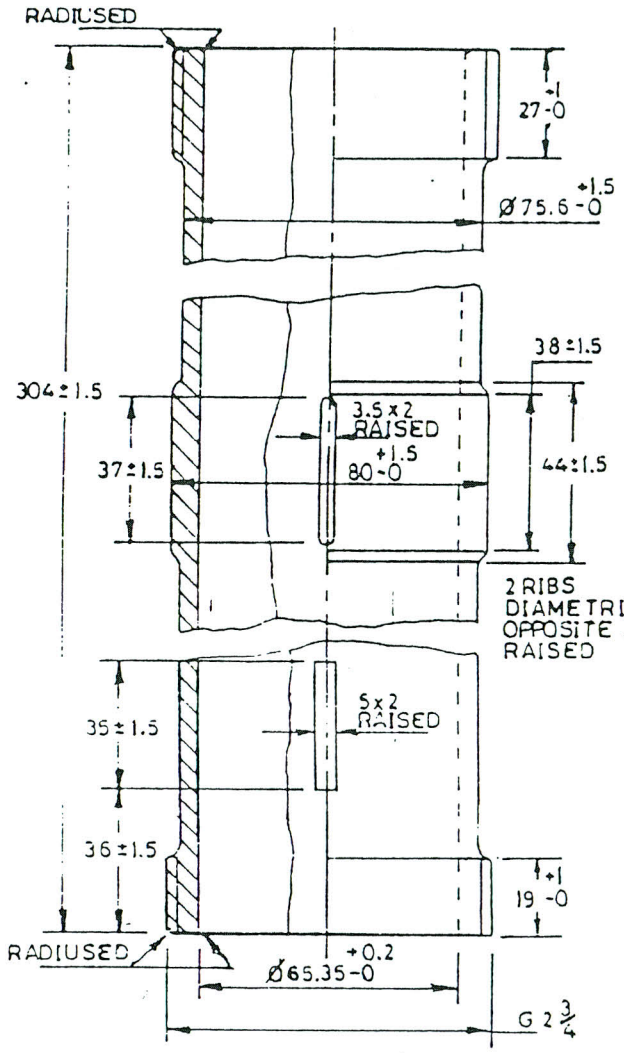



FIGURE NO : 9 CYLINDER ASSEMBLY



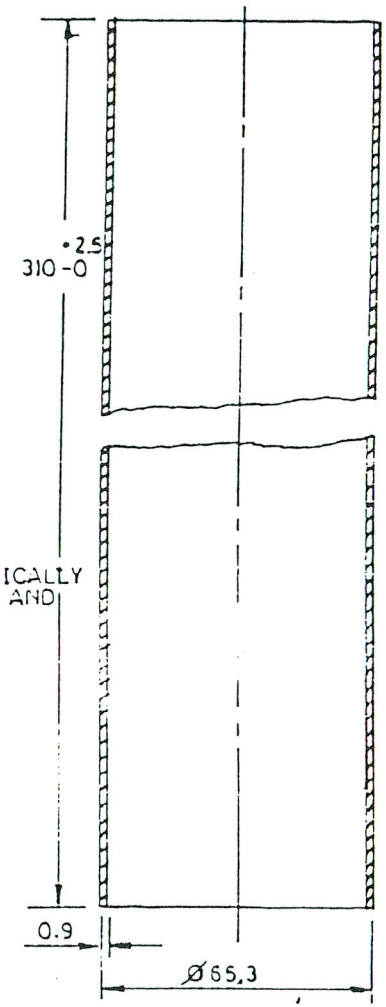

REDUCER CAP

FIGURE 9a




CYLINDER BODY

FIGURE 9b

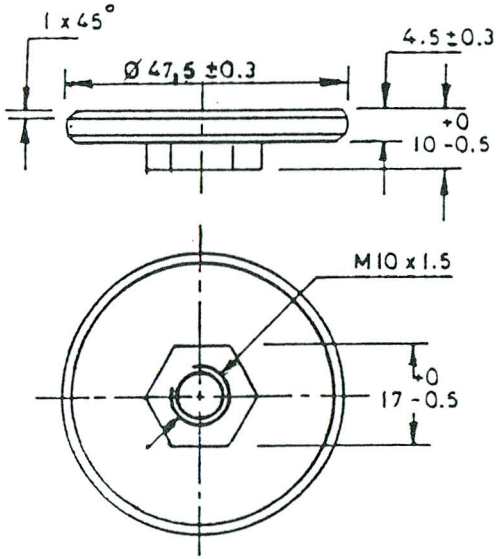



BRASS LINER

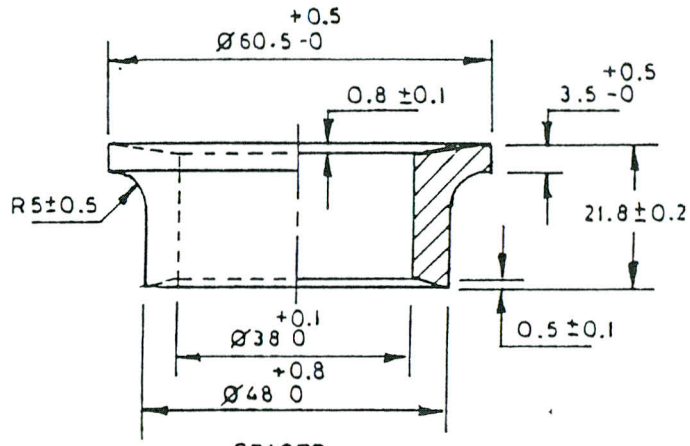
FIGURE 9c

FIGURE NO: 9a, 9b & 9c

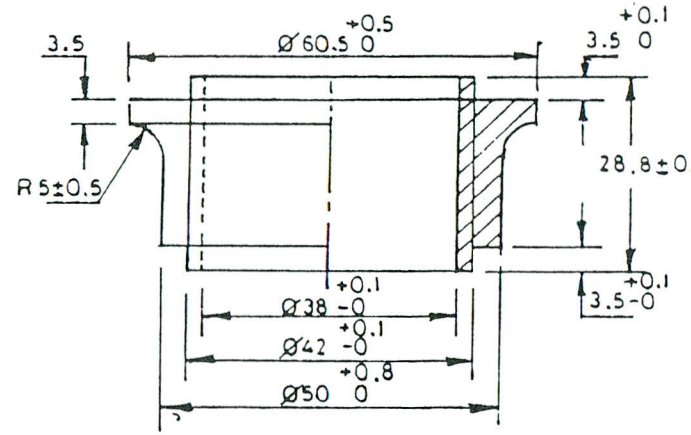
CYLINDER ASSEMBLY PARTS




RUBBER SEAT RETAINER
FIGURE 9d




SPACER
FOR LEATHER PUMP BUCKET
FIGURE 9e




SPACER
FOR NITRILE RUBBER PUMP BUCKET
FIGURE 9f

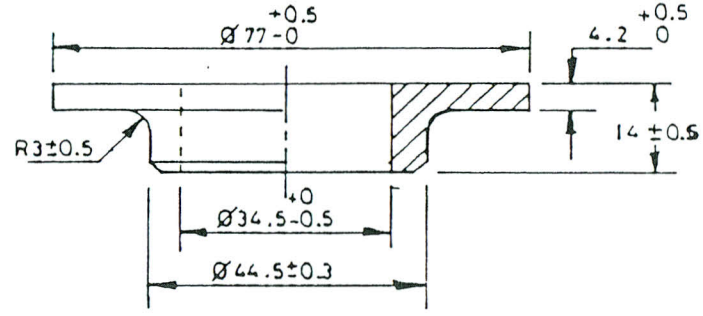
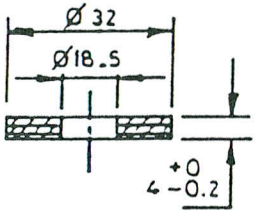


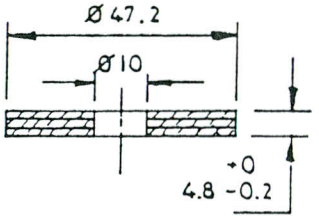

FIGURE 9g
CHECK VALVE SEAT

FIGURE NO : 9d, 9e, 9f & 9g

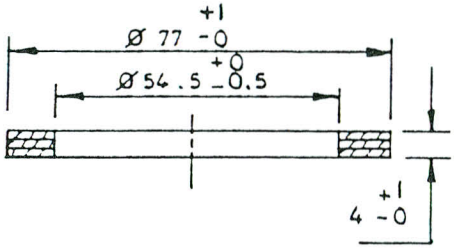
CYLINDER ASSEMBLY PARTS



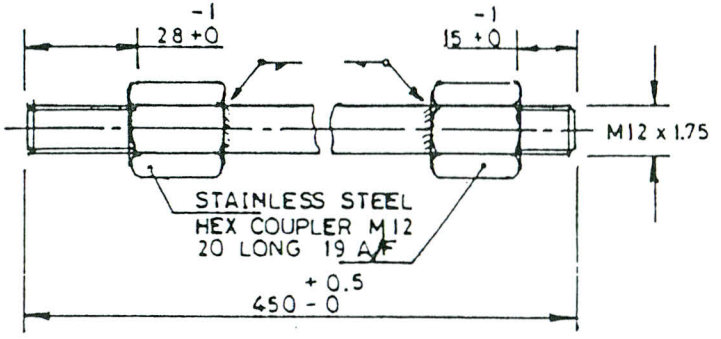

RUBBER SEATING
(UPPER VALVE)
FIGURE 9h




RUBBER SEATING
(LOWER VALVE)
FIGURE 9i




SEALING RING
FIGURE 9j




PLUNGER ROD, STAINLESS STEEL
FIGURE 9k

FIGURE NO: 9h, 9i, 9j & 9k

CYLINDER ASSEMBLY PARTS

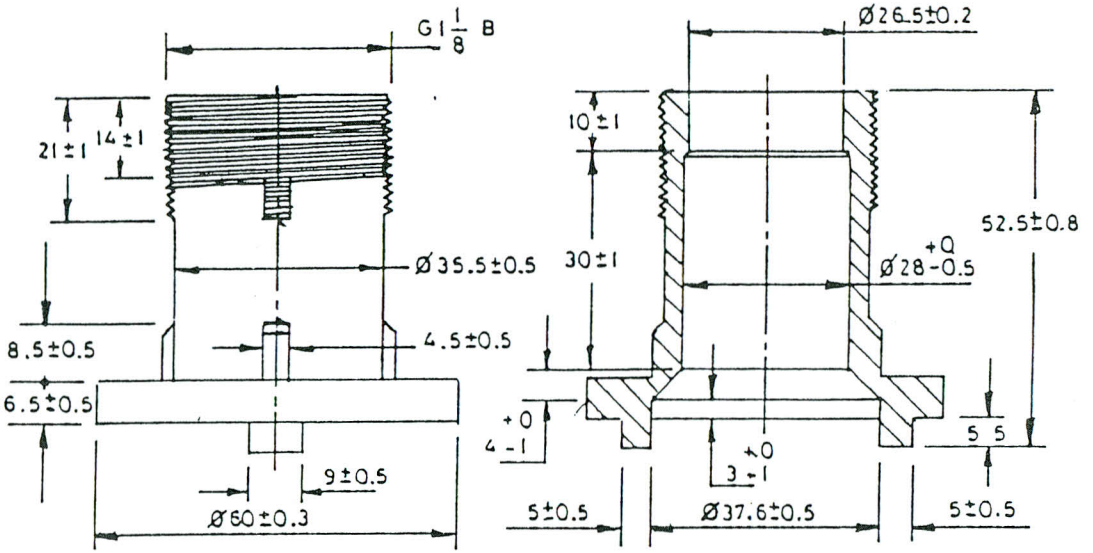



FIGURE 9l
FOLLOWER

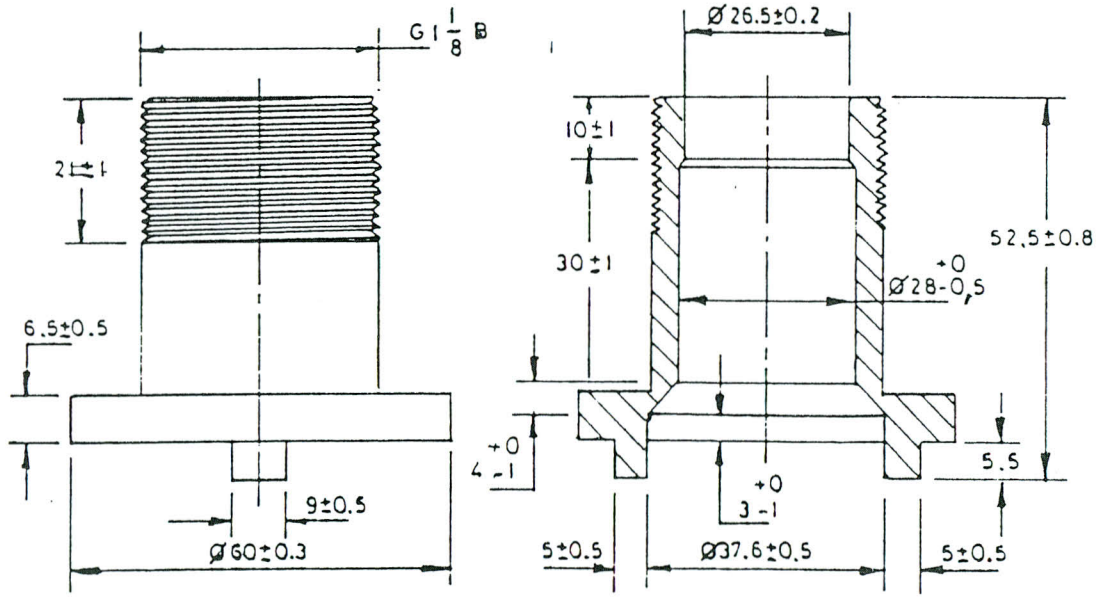



FIGURE 9m
FOLLOWER (ALTERNATE DESIGN)

FIGURE NO 9l & 9m

CYLINDER ASSEMBLY PARTS

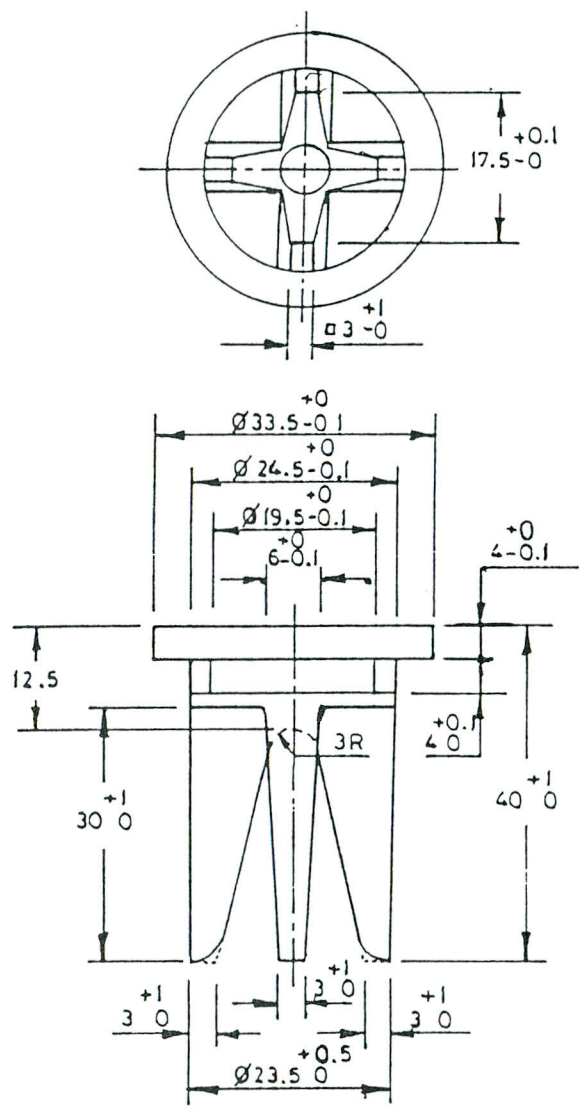



FIGURE 9n
UPPER VALVE

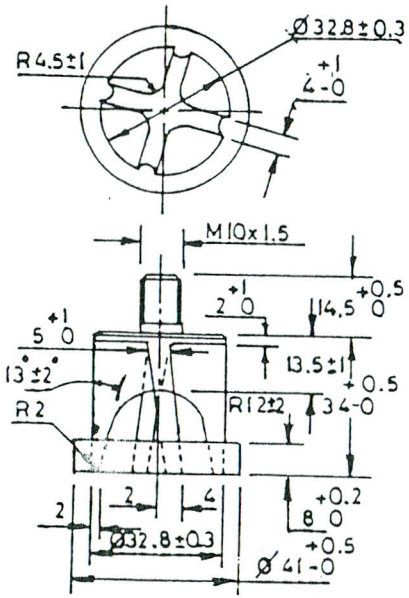
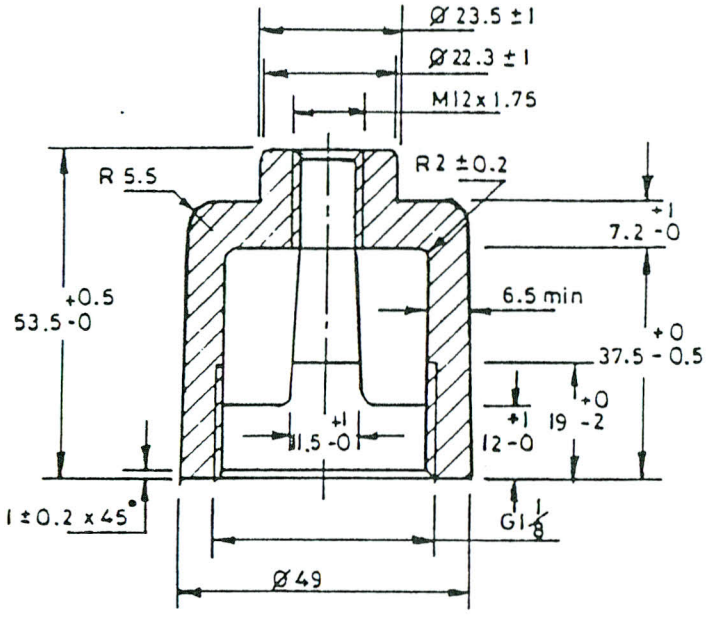
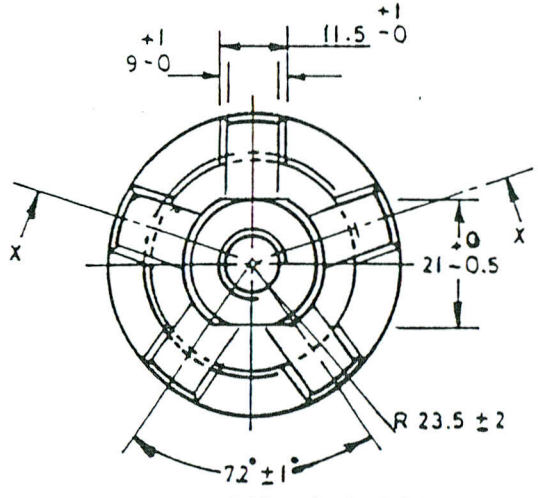



FIGURE 9p
CHECK VALVE

FIGURE NO: 9n & 9p

CYLINDER ASSEMBLY PARTS

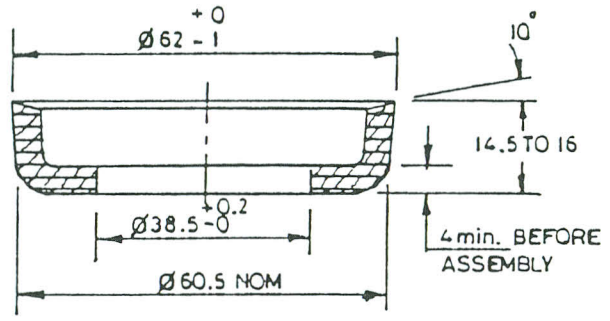


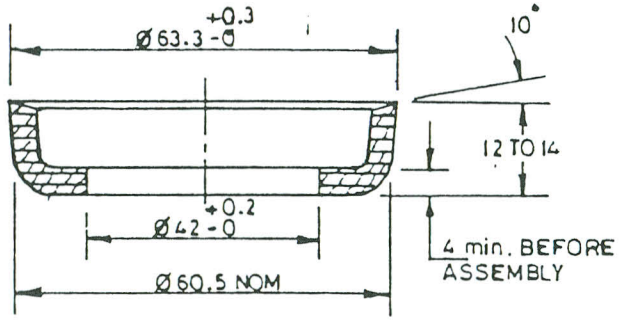

PLUNGER YOKE BODY

FIGURE NO : 9q

CYLINDER ASSEMBLY PARTS




LEATHER PUMP BUCKET
FIGURE 9r




NITRILE RUBBER PUMP BUCKET
FIGURE 9s

FIGURE NO : 9r & 9s

CYLINDER ASSEMBLY PARTS

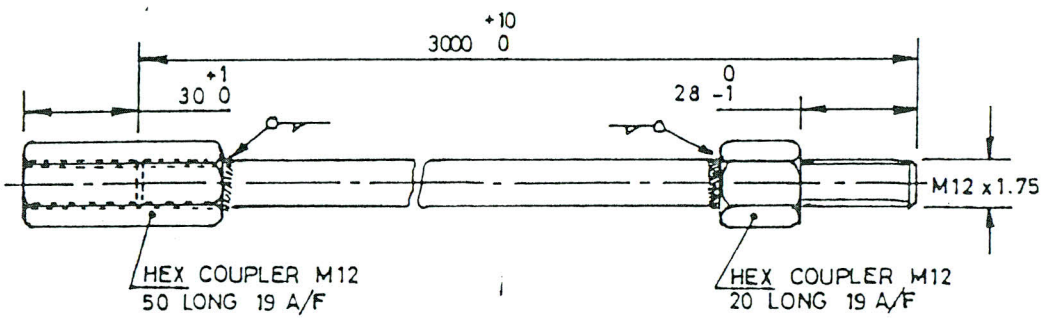



FIGURE NO : 10

CONNECTING ROD

# ANNEX A

1. ALL MILD STEEL COMPONENTS :

All mild steel components of the pump shall conform to Grade Fe 360 B of ISO 630:1980, the various specifications of which are listed below :

a) Ladle Analysis of Steel by Recognised Instrument/Chemical Method :

| Constituent | Percent Max. |
|---|---|
| - Carbon (for thickness/diameter 16mm and below) | 0.18 |
| - Carbon (for thickness/diameter over 16mm) | 0.20 |
| - Sulphur | 0.050 |
| - Phosphorus | 0.050 |
| - Nitrogen | 0.009 |

The variations permissible for the limits specified above are :

| Constituent | % Permissible deviation for non-rimming steels |
|---|---|
| - Carbon (thickness/diameter 24mm and below) | + 0.030 |
| - Sulphur | + 0.005 |
| - Phosphorus | + 0.005 |
| - Nitrogen | + 0.002 |

b) Mechanical Properties :

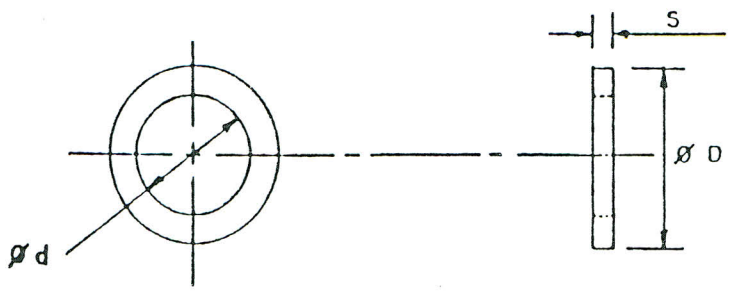
The mechanical properties of structural steel (Standard Quality) shall conform as below :

| Product | Thickness/ Diameter mm | Tensile Strength N/sq mm (Kgf/sq mm) | Yield Stress N/sq mm (Kgf/sq mm) | Percent Elongation Min. Guage Length being 5.65*sqrt So |
|---|---|---|---|---|
| Plates & Bars (Square, round and hex.) | up to and including 16 | 360 to 460 | 235 | 25 |
| | 16 up to and including 40 | 360 to 460 | 225 | 25 |
| | 40 up to and including 63 | 360 to 460 | 215 | 25 |

Note :
- 1 N/sq mm = 0.102 Kgf/sq mm.
- So = Original cross sectional area of the specimen.

2. M12 WASHER :

The M12 washers of the pump shall conform to ISO 887:1983.



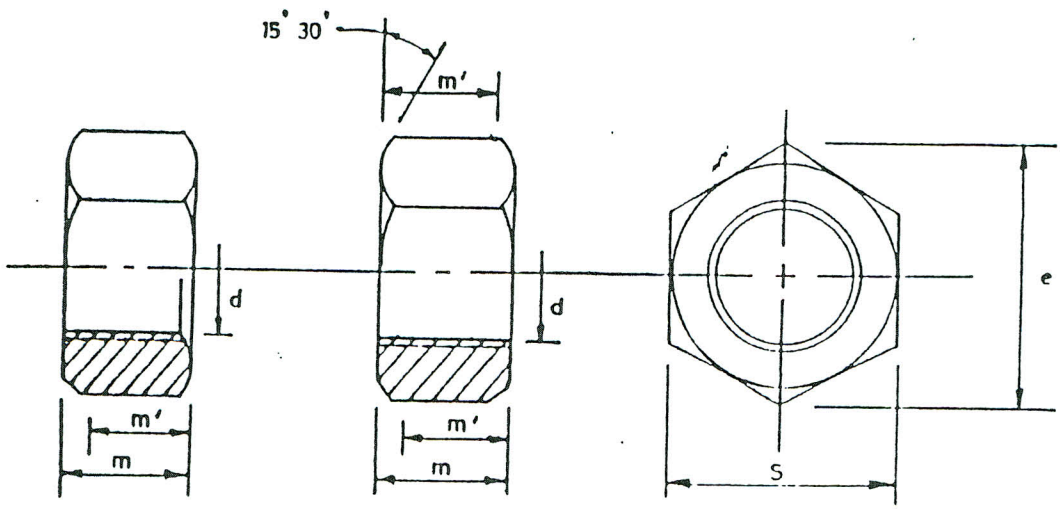

Dimensions for Punched Washers, TYPE A, for Hexagonal Bolts

| Size d mm | D nominal | s nominal | for bolt size |
|---|---|---|---|
| 13-14 | 24 | 2.5 | M12 |

The washers shall be made from steel. They shall be free from cracks, burrs, pits and other defects. The holes shall be reasonably concentric with the outer periphery. All sharp edges shall be removed.

3. M12 HEXAGONAL NUT :

All M12 Hexagonal Nuts in the pump shall conform to Product Grade C steel with Tolerance 7H of ISO 4034:1986.

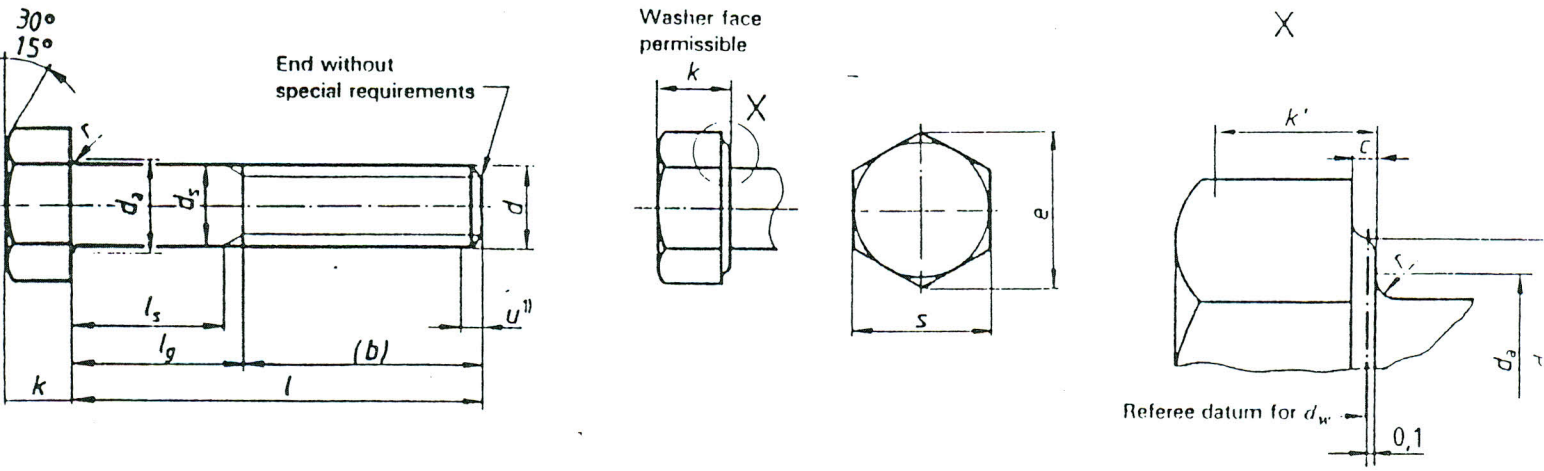


## Dimensions for Hexagonal Nuts

| Thread Size | | M10 | M12 |
|---|---|---|---|
| P (pitch) | | 1.50 | 1.75 |
| m | max. | 9.50 | 12.20 |
| | min. | 8.00 | 10.40 |
| m' | min. | 6.40 | 8.30 |
| s | Nom. max. | 16.00 | 18.00 |
| | min. | 15.57 | 17.57 |
| e | min. | 17.59 | 19.85 |

4. M12 x 20/M12 x 40 HEXAGONAL BOLT :

The bolt shall conform to Grade C steel with tolerance 8g of ISO 4016: 1988.




The following are the dimensions for bolts with thread size M12 :

| Pitch P | | 1.75 |
|---|---|---|
| c | max. | 0.60 |
| da | max. | 14.70 |
| dw | min. | 16.47 |
| e | min. | 19.85 |
| s | max. | 18.00 |
| | min. | 17.57 |

| | | |
|---|---|---|
| k | nom. | 7.50 |
| | min. | 7.05 |
| | max. | 7.95 |
| k' | min. | 4.94 |
| r | min. | 0.60 |

Note : $l$ = (b) = 20 for M12 x 20 bolt
$l$ = (b) = 40 for M12 x 40 bolt. In both cases, $l_s$ = 0.

5. FRONT COVER :

This specification is derived from CR1 Commercial Grade of ISO 3574:1986.

Chemical Composition of CR1 Commercial Grade 2mm Mild Steel Plate

| Constituent | Percent max. |
|---|---|
| Carbon | 0.15 |
| Manganese | 0.60 |
| Sulphur | 0.050 |
| Phosphorus | 0.050 |

Mechanical Property requirements for Commercial CR1 Grade cold-reduced carbon steel sheet is :

| Quality | | 180° bend mandrel diameter | Hardness maximum HRB |
|---|---|---|---|
| Designation | Name | | |
| CR1 | Commercial | 0 | 65 |

6. AXLE WASHER :

The specifications shall conform to thickness specification of the Extra Large Size and Outer Diameter specification from the Interim Size of ISO 887:1983.

7. M10 HEXAGONAL LOCK NUT :

The specifications shall conform to the prevailing Torque Type of Steel Hexagonal Lock Nut M10 of ISO 2320:1983.

8. M10 x 40 HEXAGONAL BOLT 1.5 PITCH :

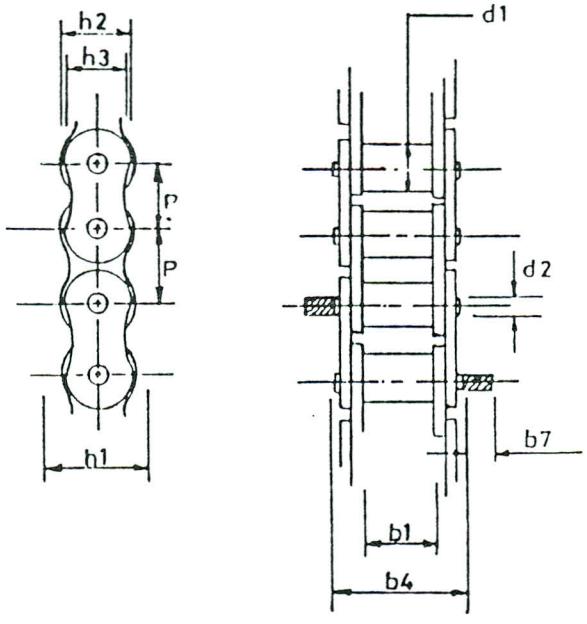
The specifications shall conform to ISO 4014:1988.

9. DOUBLE SIDE SHIELDED BEARING :

The specifications shall conform to Bearing No. 6204 ZZ or Designation 20 BC 02 PP of IS 6455 : 1972.

## 10. ROLLER CHAIN (25.4 PITCH) :

The specifications shall conform to chain no. 16B of ISO 606:1982.




P - Pitch
d1 - Roller Diameter
b1 - Width Between Inner Plates
d2 - Bearing Pin Body Diameter
h1 - Chain Path Depth
h2 - Inner Plate Depth
h3 - Outer Intermediate Plate Depth
b4 - Width Over Bearing Pins
b7 - Additional Width for Joint Fastener

The chain dimemsions, measuring loads and breaking loads for 25.4 pitch roller chain are :

| ISO Chain Number | P mm | d1 max. mm | b1 min. mm | d2 max. mm | h1 min. mm | h2 max. mm | h3 max. mm | b4 max. mm | b7 max. mm | Simple Measuring Load Kg | Simple Breaking Load Kg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 B | 25.4 | 15.88 | 17.02 | 8.28 | 21.34 | 21.08 | 21.08 | 36.10 | 5.40 | 50.00 | 4230 |

## 11. HANDLE AXLE :

The specifications shall conform to Type 11 of Austenitic Steels Cr 17 min. Ni 8 min. of ISO 683/13:1986.

## 12. CHAIN COUPLING :

The specifications shall conform to Fe 360 B of ISO 630:1980 for machined parts or Class 2 of IS 2004 : 1978 for forged parts

The chemical composition of the steel shall be as below :

| Class | Designation | Constituent Percent | | | | |
|---|---|---|---|---|---|---|
| | | Carbon | Silicon | Manganese | Sulphur max. | Phosphorus max. |
| 2 | 20 C 8 | 0.15 to 0.25 | 0.15 to 0.35 | 0.60 to 0.90 | 0.050 | 0.050 |

If the coupling is produced by Forging, then only killed steel shall be used produced by the Open Hearth, Electric or any other approved process.

A check analysis shall be done on the finished forgings and shall have the following compositions :

| Constituent | Variation from Specified Limits percent |
|---|---|
| Carbon | ± 0.02 |
| Silicon | ± 0.03 |
| Manganese | ± 0.04 |
| Sulphur | + 0.005 |
| Phosphorus | + 0.005 |

The Tensile and Hardness properties shall be as follows :

| Class | Tensile Strength min. N/sq mm | Yield Strength min. N/sq mm | Elongation Percent min. G.Length 5.65*sqrt So | Hardness min. BHN | Normalizing Temperature Deg. centigrade |
|---|---|---|---|---|---|
| 2 | 430 | 230 | 24 | 120 | 880-910 |

So = Original Cross Sectional Area of Specimen.

13. <u>SPOUT PIPE (40mm NB/1 1/2" & 25mm NB/1") and 150mm NB/6" PIPE</u> :

The specifications shall conform to St 37-2 of ISO 65:1981 and ISO 7/1:1982.

Ladle analysis of the tubes shall not show Sulphur or Phosphorus in amounts exceeding 0.06% each, as it is used for water purposes. The max. permissible variation of Sulphur and Phosphorus content is 0.005% each.

DIMENSIONAL AND NOMINAL WEIGHTS

| Nominal Bore | Outside Diameter | | Thickness | Weight of Black Tube in Kg/m | |
|---|---|---|---|---|---|
| | max. | min. | | Plain End | Screwed & Socketed |
| 25 | 34.0 | 33.2 | 3.20 | 2.41 | 2.43 |
| 40 | 48.8 | 47.9 | 3.20 | 3.56 | 3.60 |
| 150 | 166.5 | 163.9 | 4.85 | 19.80 | 20.40 |

The tolerances which shall be permitted on the thickness and of the tubes are :

Thickness :

- Butt Welded - + not limited
  - 12.5%

Weight :

- Single Tube - ± 10%

**14. 175mm NB/7" Pipe :**

The specifications shall conform to IS 1161:1979.

| Nominal Bore mm | Outside Diameter mm | Class | Thickness mm | Weight Kg/m | Area of C/Section sq cm | Int. Vol. cub.cm/m | Mom. of Inertia cm |
|---|---|---|---|---|---|---|---|
| 175 | 193.7 | Medium | 5.4 | 25 | 31.9 | 26274 | 1417 |

| Surface Area Ext. sq cm/m | Surface Area Int. sq cm/m | Modulus of Section cub. cm | Radius of Gyration cm | Square of Radius of Gyration sq cm |
|---|---|---|---|---|
| 6085 | 5746 | 146 | 6.66 | 44.36 |

The tolerances for the above are :

a) Thickness :

Welded tubes - + not limited
- 10%

b) Outside Diameter : ± 1%

c) Weight :

Single Tube (irrespective of quantity) - + 10%
- 8%

**15. 40 x 40 x 6mm ANGLE IRON :**

The specifications shall conform to IS 803 : 1979.

# ANNEX B

## 1. RISING PIPE :

The riser pipe shall be 32mm (U2) or 65mm (U3) nominal bore, screwed and socketed, 3 meters in length with a tolerance of + 0 and - 25 mm or + 0 and - 50 mm respectively. The table below gives the different types of riser pipes to be used for the different types of water quality and chemistry :

| WATER QUALITY | CONNECTING RODS | RISER PIPES | CYLINDER |
|---|---|---|---|
| - pH value 5.5 or more<br>- Oxygen level 2mg/ltr or less | Galvanised Mild Steel (GI) | Galvanised Mild Steel (GI) | Cast Iron with Brass Liner |
| - pH value 5.5 or less<br>- Chloride level upto 200 mg/ltr | Stainless Steel AISI 304 | Stainless Steel AISI 304 | Cast Iron with Brass Liner or SS AISI 304 |
| - pH value 5.5 or less<br>- Chloride level more than 200 mg/ltr | Stainless Steel AISI 316 | Stainless Steel AISI 316 | Cast Iron with Brass Liner or SS AISI 316 |

### (a) Galvanised Mild Steel (GI) Pipe :

The specifications shall conform to the Medium class of IS 1239 (part 1) : 1979. They shall be 32mm NB (U2) pipes or 65mm NB (U3) pipes, Hot-Dip Galvanized, Screwed and Socketed, in 3m lengths, and with tolerance in length of + 0mm and - 32mm or + 0 and - 50mm respectively.

Chemical Composition :

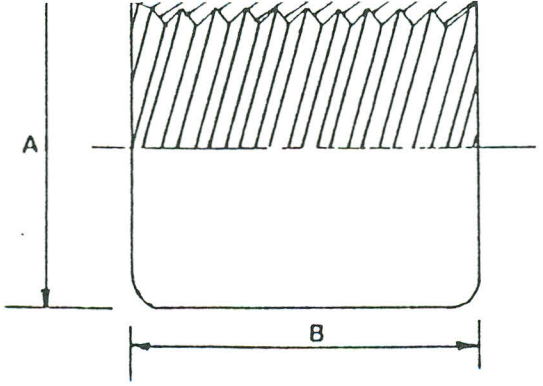
The Ladle Analysis shall not show Sulphur and Phosphorus in amounts exceeding 0.06% each. Max. permissible variance of Sulphur and Phosphorus shall be 0.005% each.

### Dimensions & Nominal Weight of Black Pipe

| Nominal Bore | Outside Diameter | | Thickness | Weight of Black Pipe Screwed and Socketed Kg/m |
|---|---|---|---|---|
| | max. | min. | | |
| 32 | 42.9 | 42.0 | 3.25 | 3.17 |
| 65 | 76.6 | 75.3 | 3.65 | 6.63 |

### Dimensions of Socket

| Nominal Bore | Outside Diameter, A min. | Length, B min. |
|---|---|---|
| 32 | 49 | 51 |
| 65 | 84 | 69 |




The minimum length is increased to allow for chamfer at ends and is based on :

$$B = 2L + 3\ 1/2P$$

Where L = Length of usable thread on pipe end.

P = Pitch of thread.

Tolerance on Thickness and Weight :

a) Thickness :

Butt welded - + not limited
- 10%

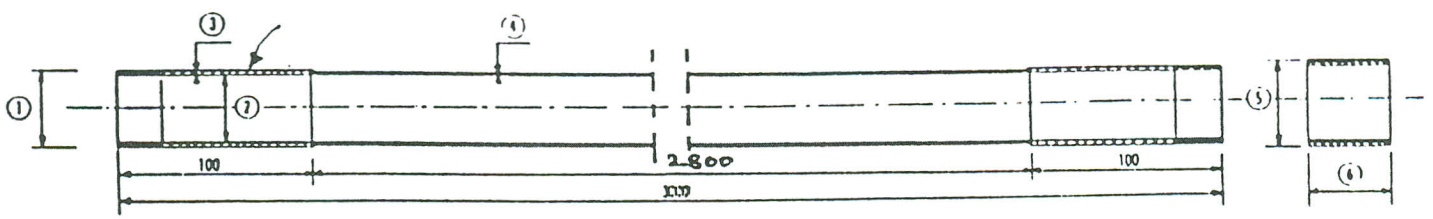
Seamless - + not limited
- 12.5%

b) Weight :

Single tube - ± 10%
For quantities per load of 10 tons min. - ± 7.5%

(b) **Stainless Steel Pipe** :

The specifications shall conform to AISI 304 or AISI 316 as in the table given above in (1). The figure below gives the basic dimensional requirements and the minimum wall thickness for the pipes.




| Diameter NB mm | Thread BSP | 1 mm | 2 mm | 3 mm | 4 mm | 5 mm | 6 mm | Weight Kgs | Tensile Strength Kgs |
|---|---|---|---|---|---|---|---|---|---|
| 32 | 1 1/4" | 42.4 | 36.0 | 3.2 | 1.5 | 48.0 | 45.0 | 4.8 | 5000 |
| 65 | 2 1/2" | 76.1 | 68.9 | 3.6 | 1.5 | 83.0 | 50.0 | 10.2 | 8000 |

2. CONNECTING ROD :

The specifications shall conform to 12mm diameter Bright Bar Type 4 and Grade 2 or 3 of Steel other than Free Cutting Steel, of IS 9550 : 1980.

Mechanical Properties of Cold Drawn Bright Bar (Grade 2 or 3 Type 4)

| Grade | size | Tensile Strength Mpa | Elongation on Guage Length 65 * sqrt So Percent min. for steels other than free cutting |
|---|---|---|---|
| 2 | 12mm | 540 - 790 | 13 |
| 3 | 12mm | 610 - 790 | 12 |

**Note** : 1 Mpa = 1 N/sq mm = 1 MN/sq m = 0.1020_Kgf/sq mm

Minimum values for Yield Stress may be taken as 65 - 80% of the minimum Tensile Strength.

Grade 2 is generally recommended for Carbon Steels where as Grade 3 is recommended for medium Carbon and Low Alloy Steels.

**Dimensions and Dimensional Tolerances :**

The dimensional tolerances for cold drawn bright bars shall be as given in the table below :

| Size in mm Dia. | | Variation Max. mm for cold drawn bars |
|---|---|---|
| Over | Up to | |
| 10 | 18 | - 0.11 |

MAXIMUM PERMISSIBLE DEPTH OF SURFACE DEFECTS FOR COLD DRAWN BRIGHT BARS

| Dimensions (Dia) in mm | | Depth Measured from surface of bar in mm TYPE 4 |
|---|---|---|
| Over | Up to | |
| 10 | 18 | 0.44 |

# ANNEX C

**1. WELDING :**

The specifications shall conform to IS 9595 : 1980.

**2. CASTINGS :**

Iron castings shall conform to Grade FG 200 or higher of IS 210 : 1978.

Bronze castings shall conform to Grade LTB 2 of IS 318 : 1981.

**3. ELECTROGALVANIZING AND PASSIVATION :**

The specifications shall conform to Fe/Zn 25 of ISO 2081:1986.

Zinc Coating Requirements

| Classification No. | Local Thickness min. microns |
|---|---|
| Fe/Zn 25 | 25 |

**4. Hot Dip Galvanising :**

The specifications for Hot Dip Galvanising shall conform to ISO 1461:1973, the various specification of which are as follows :

**General Remarks :**

The hot dip galvaniser shall not be held responsible for changes in mechanical properties of the basic material as a result of hot dip galvanising.

When it is neccessary to bore vent holes in products to prevent explosions during hot dip galvanising, this shall be done by the purchaser or, after the written consent of the purchaser, by the hot dip galvaniser. The purchaser is strongly recommended to seek the advice of the hot dip galvaniser before designing or making a product which is subsequently to be hot dip galvanised.

Oversize tapping or retapping of nuts and tapped holes is required when the bolt or male thread is hot dip galvanised. Although tapping or retapping after hot dip galvanising results in an uncoated female thread, the coating on the engaged male thread will retard corrosion of both components. Male threads shall not be rethreaded after hot dip galvanising.

**Adhesion of the Coating :**

The coating shall be sufficiently adherent enough to withstand handling consistent with the normal use of the article without peeling or flaking.